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A new *Corydoras* Lacépède, 1803 (Siluriformes: Callichthyidae) from the rio São Francisco basin, Brazil

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A new species of *Corydoras* is described from the rio São Francisco basin in northeastern Brazil, Minas Gerais and Bahia States. The new species is distinguished from most of its congeners by the anterior portion of the infraorbital 1 very large, conspicuously expanded towards the anteroventral margin of the snout and almost entirely covering its lateral margin. Other characters that distinguish the new species are the infraorbital 2 slender on its dorsal tip, contacting only sphenotic and not compound pterotic; and the presence of two laterosensory canals on trunk. A phylogenetic analysis including the new species found it sister-group of *C. flaveolus*, and both species sister-group of *C. paleatus*. An identification key to the species of the rio São Francisco basin is also provided.

Uma espécie nova de *Corydoras* é descrita da bacia do rio São Francisco no nordeste do Brasil, estados de Minas Gerais e Bahia. A espécie nova se distingue da maioria de suas congêneres por apresentar a porção anterior do infraorbital 1 muito desenvolvida, expandindo-se conspicuamente em direção à margem anteroventral do focinho, quase cobrindo completamente sua margem lateral. Outros caracteres que distinguem a espécie nova são o infraorbital 2 estreito em sua extremidade dorsal, em contato apenas com o esfenótico e não com o pterótico composto, e presença de somente dois canais látero-sensoriais no tronco. Uma análise filogenética incluindo a espécie nova encontrou-a como grupo-irmão de *C. flaveolus*, e ambas como grupo-irmão de *C. paleatus*. Uma chave para identificação das espécies da bacia do rio São Francisco também é fornecida.

Key words: Corydoradinae, Mimetic communities, Neotropical, Rio Guarda-Mor, Systematics.

Introduction

Callichthyidae species can be easily recognized by having two longitudinal series of dermal plates (Reis, 2003). Currently the family harbors 197 valid species, grouped in eight genera (Britto, 2003; Britto *et al*., 2007; Eschmeyer, 2012). From that total, 156 species are included in *Corydoras* Lacépède, 1803, the most speciose genus of Siluriformes (Reis, 2003; Ferraris, 2007). *Corydoras* representatives are widely distributed throughout South America and show relative economic importance among ornamental fish keepers (Reis, 2003).

After the first more comprehensive revision of Callichthyidae conducted by Gosline (1940), some attempts for grouping species of *Corydoras* were carried out, firstly by Nijssen (1970) and later by Nijssen & Isbrücker (1980), both defining groups of different species using morphometric characters and coloration pattern. Britto (2003) proposed a phylogenetic hypothesis for the Corydoradinae based on 83 characters, by that time the more comprehensive work for the subfamily, establishing among *Corydoras* a large polytomy with most species grouped in nine clades. Thereby, the phylogenetic relationships recovered by Britto (2003) revealed that *Corydoras* is still poorly known. In the same work, Britto's results show *Scleromystax* as a valid genus and sister-group of *Aspidoras*, in addition *Brochis* Cope, 1871 was placed into the synonymy of *Corydoras*.

The rio São Francisco basin is one of the most important Brazilian basins, based on its length, water volume and economic importance. Its drainage area represents about 8% of the Brazilian territory (ANA, 2012). The diversity of *Corydoras* in the basin is low, hitherto with only three recognized species, *C. garbei* Ihering, 1911, *C. difluviatilis*

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Britto & Castro, 2002 and *C. multimaculatus* Steindachner, 1907. Examination of material collected in some localities of this basin revealed a new species of *Corydoras*, which is described herein.

Material and Methods

Measurements were obtained using digital caliper to the nearest millimeter. Morphometric and meristic data were taken following Reis (1997), excepting the length of the anal-fin spine, absent in all Corydoradinae. The length of the pectoral-fin spine was included in the morphometric analysis and was taken from its base to its distal tip. Morphometrics are reported as percentages of standard length (SL) and head length (HL). Nomenclature of barbels followed Britto & Lima (2003). Some specimens were cleared and stained (c&s) according to the protocol of Taylor & Van Dyke (1985), and counts of vertebrae followed Britto *et al*. (2009). Osteological terminology was based on Reis (1998), except for the use of parietosupraoccipital instead of supraoccipital (Arratia & Gayet, 1995) and compound pterotic instead of pterotic-supracleithrum (Aquino & Schaefer, 2002). In the description, numbers in parentheses represent the total number of specimens with those counts. Numbers with an asterisk refer to the counts of the holotype. Phylogenetic analyses were performed using the character-data matrix published by Britto (2003), including outgroup data provided in that study, with the addition of the new species. The analysis was performed using T.N.T. software (Goloboff *et al*., 2008) via a traditional heuristic search performed using the stepwise addition algorithm associated with tree bisection reconnection in a total amount of 10,000 samples. Attributes of connectivity and ambiguity among character-states were treated in the same way as in Britto (2003). Institutional abbreviations are: MCP, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica, Porto Alegre; MNRJ, Museu Nacional, Rio de Janeiro; MZUSP, Museu de Zoologia da Universidade de São Paulo, São Paulo; NUP, Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura da Universidade Estadual de Maringá, Maringá; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Results

Corydoras lymnades, new species
Fig. 1

Holotype. MNRJ 40186, 29.7 mm SL, Brazil, Minas Gerais, Guarda-Mor, rio Guarda-Mor, rio São Francisco basin, 17°46'18"S 47°05'43"W, 19 Jul 2008, C. H. Zawadzki, V. S. Ferreira, B. F. Morales & C. Pereira.

Paratypes. All from Brazil, rio São Francisco basin. **Bahia.** MNRJ 22370, 1, 22.5 mm SL, channel of the rio São Francisco, near the mouth of the rio Icatu, southeast of Ibaraba, 10°48'13"S 42°50'38"W, 15 Aug 2001, P. A. Buckup. **Minas Gerais.** MCP 16916, 72, 16.0-19.4 mm SL, 2 c&s, 16.0-19.4 mm SL, Monte Azul, córrego Salinas, 15°12'53"S 43°15'49"W, 19 Jul 1993, R. Reis, J. Silva, E. Pereira & S. Schaefer. MCP 17047, 12, 16.5-21.6 mm SL, Montalvânia, rio Carinhanha in Juvenília, about 30 km NE of Montalvânia, 14°16'00"S 44°10'00"W, 16 Jul 1993, R. Reis, J. Silva & E. Pereira. MCP 17050, 20, 17.8-28.6 mm SL, 1 c&s, 17.8-28.1 mm SL, Manga, arroio in São João das Missões, on the road between Itacarambi and Manga, 14°52'46"S 44°05'00"W, 15 Jul 1993, R. Reis, J. Silva, E. Pereira & S. Schaefer. MCP 23492, 4, 17.0-18.6 mm SL, Juvenília, rio Carinhanha on the farm of the Fundação Caio Martins, 14°15'00"S 44°09'00"W, 30 Jul 1993, H. Godinho. MCP 28271, 14, 22.5-28.3 mm SL, 2 c&s, 24.0-27.7 mm SL, Guarda-Mor, córrego Macaúba, Coromandel/Guarda-Mor road, tributary to rio Claro, 17°58'57"S 47°06'41"W, 24 Jan 2001, C. Lucena, J. Silva, E. Pereira & A. Cardoso. MCP 29024, 3, 20.0-23.9 mm SL, Januária, rio Peruaçu, on the border Januária/Itacarambi, 15°10'55"S 44°09'21"W, 14 Oct 2001, M. Brito & B. Nogueira. MCP 47023, 1, 24.8 mm SL, rio Peruaçu in the locality of Cachoeira, Januária/Itacarambi, 15°10'54"S 44°09'20"W, 30 Jul 2003, M. Brito & B. Nogueira. MCP 47024, 1, 24.7 mm SL, Januária, rio Peruaçu, Fabião I district, 15°10'37"S 44°12'32"W, 30 Jul 2003, M. Brito & B. Nogueira. NUP 9965, 13, 23.0-29.0 mm SL; NUP 13834, 1 c&s, 24.7 mm SL; NUP 13835, 1 c&s, 23.1 mm SL; all collected with the holotype.

Diagnosis. *Corydoras lymnades* is distinguished from most congeners, except *C. aeneus*, *C. britskii*, *C. coppenamensis*, *C. difluviatilis*, *C. eques*, *C. garbei*, *C. multiradiatus*, *C. rabauti*, *C. splendens*, and *C. zygatus*, by the anterior portion of the first infraorbital very large, conspicuously expanded towards the anteroventral margin of the snout and almost entirely covering its lateral margin (*vs*. anterior expansion small in *C. hastatus*, *C. pygmaeus*, and *C. panda*; or anterior expansion large, but not covering significantly the lateral margin of the snout in remaining species of *Corydoras*). The new species is distinguished from *C. aeneus*, *C. britskii*, *C. difluviatilis*, *C. eques*, *C. garbei*, *C. multiradiatus*, *C. rabauti*, *C. splendens*, and *C. zygatus* by the second infraorbital slender on its dorsal tip, contacting only sphenotic (*vs*. dorsal tip of second infraorbital wide, contacting sphenotic and compound pterotic by means of a triangular expansion). It is distinguished from *C. coppenamensis* by presence of two laterosensory canals on trunk (*vs*. three laterosensory canals on trunk). See additional diagnostic characters on identification key and discussion.

Description. Morphometric data presented in Table 1. Head compressed with slightly convex dorsal profile; roughly triangular in dorsal view. Snout rounded. Head profile convex from snout to tip of posterior process of parietosupraoccipital. Profile slightly convex along dorsal-fin base. Postdorsal body profile concave to adipose-fin spine; markedly concave from this point to caudal-fin base. Ventral profile of body nearly straight from isthmus to pectoral girdle; slightly convex from this point until pelvic girdle. Profile nearly straight from pelvic girdle to base of first anal-fin ray; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed towards caudal fin.

Fig. 1. *Corydoras lymnades*, holotype, MNRJ 40186, 29.7 mm SL, Brazil, Minas Gerais, Guarda-Mor, rio Guarda-Mor, rio São Francisco basin, 17°46'18"S 47°05'43"W. Dorsal, lateral and ventral views.

Eye roughly elliptical, largest orbit diameter in oblique axis between top of head and upper lip. Eye located dorsolaterally on head; orbit delimited dorsally by frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by a flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to diameter of naris. Mouth small, subterminal, width nearly equal to bony orbit diameter. Maxillary barbel elongate, reaching anteroventral limit of gill opening in some individuals. Maxillary barbel slightly longer than outer mental barbel. Inner mental barbel fleshy, base close to its counterpart. Small rounded papillae covering entire surface of all barbels, upper and lower lips, and isthmus.

Four branchiostegal rays decreasing in size posteriorly; distal tips of first two outer rays longer and connected to

Table 1. Morphometric data of *Corydoras lymnades*. n = number of specimens and SD = standard deviation.

	n	Holotype	Low-High	Mean±SD
Standard length (mm)	31	29.7	22.5-29.7	24.8±2.3
Percents of standard length				
Depth of body	31	32.7	28.3-34.3	30.9±1.6
Predorsal distance	31	46.1	42.5-50.8	45.5±1.7
Prepelvic distance	31	44.4	42.2-48.7	44.8±1.7
Preanal distance	31	79.5	75.9-82.5	78.6±1.6
Preadipose distance	31	81.5	74.6-84.1	78.7±2.3
Length of dorsal spine	31	22.2	16.8-24.3	20.8±2.1
Length of pectoral spine	31	26.3	22.8-29.4	25.8±1.8
Length of adipose-fin spine	30	12.8	6.4-12.8	9.4±1.2
Depth of caudal peduncle	31	12.8	11.7-14.7	13.3±0.8
Length of dorsal-fin base	31	19.2	13.7-21.2	16.4±2.4
Dorsal to adipose distance	31	21.9	15.5-21.9	18.4±1.5
Maximum cleithral width	31	30.0	24.5-31.1	27.8±1.6
Head length	31	40.4	36.1-42.0	39.3±1.4
Length of maxillary barbel	31	16.2	10.1-20.9	14.9±2.9
Percents of head length				
Head depth	31	75.0	68.8-83.2	74.6±3.3
Least interorbital distance	31	24.2	22.8-30.9	27.3±1.8
Horizontal orbit diameter	31	22.5	20.8-29.7	24.2±2.4
Snout length	31	37.5	29.2-39.5	36.8±2.2
Least internarial distance	31	9.2	4.4-14.9	10.1±2.4

branchiostegal cartilage; distal tips of last two inner rays shorter, fourth ray about half length of first ray. Hypobranchial 2 roughly triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice larger cartilaginous portion. Five ceratobranchials increasing in size posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 notched on postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 23 to 31(3) teeth aligned in one row. Four epibranchials reducing size posteriorly; epibranchial 2 with small pointed process on laminar expansion of posterior margin, epibranchial 3 with small uncinate process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with large triangular process on posterior margin. Upper tooth plate oval; 33 to 37(3) teeth aligned in two rows on postero-ventral surface.

Mesethmoid short, posterior portion partially exposed and possessing minute odontodes. Nasal slender, curved laterally, mesial border contacting mesethmoid and frontal. Frontal elongated, narrow, width less than half entire length; anterior projection long, size greater than nasal length; small process on antero-lateral margin; epiphysial branch of supraorbital canal short, pore opening located mesially on frontals. Frontal fontanel large, oval; anterior margin just posterior to middle of the eye, posterior margin extension variable, ending at parietosupraoccipital margin or slightly entering its anterior margin. Parietosupraoccipital wide, posterior process long and contacting nuchal plate. Two laminar infraorbitals with minute odontodes; infraorbital 1 large, anterior portion largely expanded, almost entirely covering lateral margin of snout (Fig. 2a), inner expansion large; infraorbital 2 small, postero-ventral margin contacting preopercle, dorsal tip slender, contacting sphenotic, inner expansion large. Interopercle covered by thick layer of skin, triangular, anterior projection short. Preopercle slender, elongated, small odontodes sparse on external surface. Opercle dorso-ventrally elongated, length about two times width, free margin smooth, with sparse minute odontodes.

Dorsal-fin rays II,8*(30) or II,9(1) inner margin of dorsal-fin spine with nine to 16 weak-developed serrations, concentrated on distal portion of spine; nuchal plate exposed with minute odontodes; spinelet short; spine long, adpressed distal tip slightly surpassing base of last branched dorsal-fin ray, posterior margin with weak-developed serrations. Pectoral-fin rays I,7(31); inner margin of pectoral spine with 20-27 well-developed serrations along its entire length. Outer margin of pectoral spine with one to five serrations located on distal portion in some specimens (Fig. 3). Pelvic-fin rays i,5(31). Anal-fin rays i,6 (1), ii,4(4), or ii,5*(28). Caudal-fin rays i,12,i(31), generally three upper and lower procurrent rays, respectively. Cleithrum exposed on anteroventral portion;

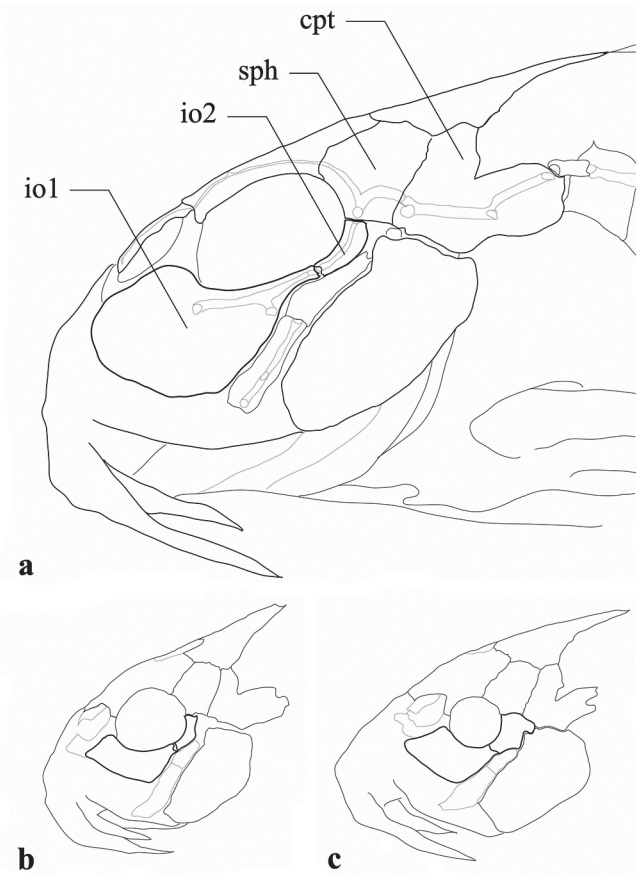

Fig. 2. Schematic drawing of the head of (**a**) *Corydoras lymnades*, (**b**) *Corydoras flaveolus* and (**c**) *Corydoras difluviatilis* in lateral view. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic.

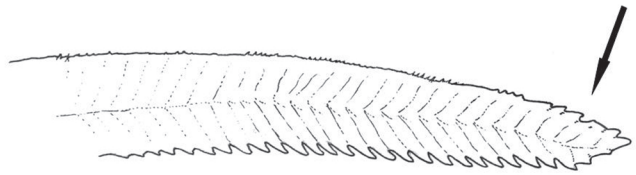

Fig. 3. Pectoral-fin spine (7.1 mm) of *Corydoras lymnades*, NUP 9965, 28.0 mm SL, showing the serrations in inner margin of the right spine. The arrow indicates the serration in outer margin of the spine distal portion, present in some specimens.

coracoid exposed on posterolateral portion; small odontodes sparse on exposed areas. Free vertebrae 22(3); ribs 5(3), first pair conspicuously large.

Two laterosensory canals on trunk; first ossicle tubular, second ossicle laminar. Body plates with minute odontodes scattered over exposed area, a conspicuous line of odontodes confined on posterior margins; dorsolateral body plates 23(2), 24*(22), or 25(9); ventrolateral body plates 20(3), 21*(18), or 22(12); dorsolateral body plates along dorsal-fin base 5(13), 6*(12), 7(4), or 8(2); dorsolateral body plates between adipose and caudal fins 8*(21), or 9(10); preadipose platelets 2*(12), 3(15), 4(4), or 5(1), adipose spine opposed to anal-fin insertion; small platelets covering base of caudal-fin rays; small platelets disposed dorsally and ventrally between junctions of lateral plates on posterior portion of caudal peduncle.

Color in alcohol. Ground coloration of head yellowish light-brown with entire top of the head dark brown. Small rounded or striated dark brown blotches scattered over dorsal and lateral areas of head and trunk. Diffuse dark stripe between corner of mouth and anterior margin of orbit. Opercle and preopercle with several, small, scattered dark brown chromatophores over their surfaces. Chromatophores more concentrated over anterior border of opercle. Irregular, dark-brown blotch on dorsal portion of opercle (Fig. 4).

Ground color of trunk yellowish light brown. Cleithrum with rounded, dark-brown blotch on dorsal portion. Two or four elongated dark-brown blotches over junction of dorso- and ventrolateral body plates. Anterior blotch less conspicuous; posteriormost blotches just below adipose fin and on caudal-fin base, respectively.

Ground color of fins light yellow; interradial membranes hyaline. Dorsal-, pectoral- and caudal-fin rays with minute, scattered, elongated blotches. Pelvic- and anal- fin rays without spots. Small dark-brown areas on anterior margin of dorsal and adipose fins and caudal-fin base.

Distribution. *Corydoras lymnades* is known from upper and middle rio São Francisco basin, from headwater streams in the Minas Gerais State to the main channel of the river in the Bahia State, northeastern Brazil (Fig. 5).

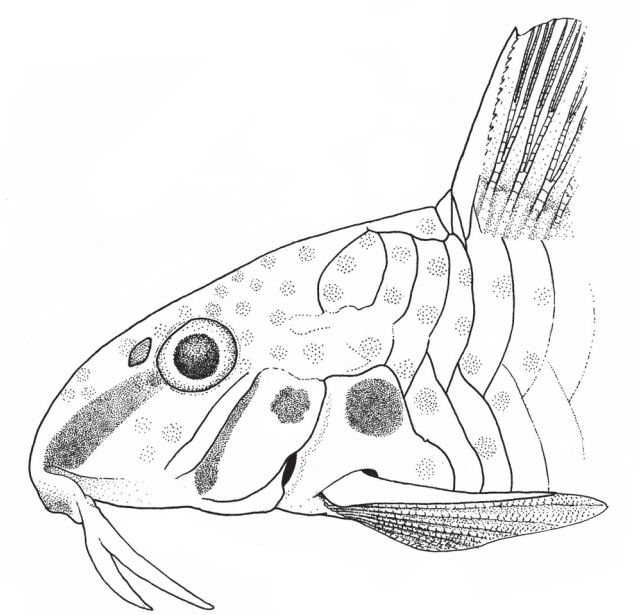

Fig. 4. Schematic drawing showing color pattern details in anterior portion of the body of *Corydoras lymnades*, based in a paratype, NUP 9965, 28.7 mm SL.

Etymology. The Lymnades are small creatures derived from the Goblins, according to Greek mythology. They live around lakes and have the task to protect the Nymphs from men that dare to try get close to them. The legend says that the Lymnades have the divine power of see in the bottom of a man's soul and take the form of the most beloved person for the unwary that invade the territory of the nymphs. After deceiving the victims they kill and devour them. The new species is a close resemblance with *Corydoras garbei*, a similar look species considering its body coloration but with evidently larger individuals. The epithet *lymnades* makes allusion with the small size of the new species and its coloration similarity with *C. garbei*. A noun in apposition.

Identification key to the species of *Corydoras* from the rio São Francisco basin

1. Nuchal plate deeply in contact with posterior process of parietosupraoccipital by a small notch in the latter; snout relatively rounded 2
1'. Nuchal plate not in contact with posterior process of parietosupraoccipital; snout relatively pointed ..... *C. difluviatilis*
2. Body with a series of relatively large dark blotches along junction of body plates; first infraorbital very large, conspicuously expanded towards its anteroventral margin, and almost entirely covering lateral margin of the snout (Fig. 2a) 3

2'. Body with small dark blotches scattered all over the flank and dorsum, not forming defined series; first infraorbital large, but not covering significantly the lateral margin of the snout (Fig. 2b) ..... *C. multimaculatus*

3. Dorsum with a series of longitudinal blotches, one on anterior origin of dorsal fin base, other on posterior origin of dorsal fin base, the third on the base of adipose fin and the last one on the base of caudal fin; rounded blotches on junction of lateral body plates; body deep (approximately 38.5% of SL) ..... *C. garbei*

3'. Dorsum with small rounded or striated blotches scattered over the aforementioned areas; oblong blotches on junction of lateral body plates; body slender (approximately 30.9% of SL) ..... *C. lymnades*

Discussion

The color pattern of *Corydoras lymnades* is very similar to those of *C. cochui*, *C. garbei*, and mainly *C. flaveolus*. The three mentioned congeners present a longitudinal series of conspicuous dark blotches on dorsum, on origin and end of dorsal fin base, posteriormost blotches on adipose and caudal-fin bases. On the other hand, *C. lymnades* presents only some scattered, small, rounded or striated blotches on these regions (Fig. 1). Furthermore, it is common the presence of a series of blotches below the junction of lateral plates, and between pelvic and caudal fins in *C. flaveolus* and *C. garbei*; while *C. lymnades* lacks this series.

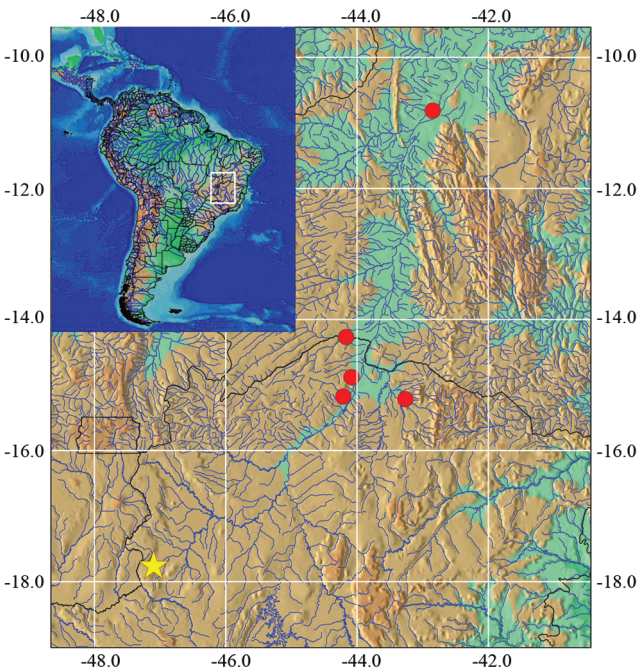

Fig. 5. Map showing geographic distribution of *Corydoras lymnades*. Yellow star represents type locality, rio Guarda-Mor, Minas Gerais State. Each symbol may represent more than one locality.

Despite the very similar color pattern, the new species can be clearly distinguished from the aforementioned congeners, with exception of *C. garbei*, by the presence of a very large anterior expansion in first infraorbital (Fig. 2a), while other species present just a large expansion (see Fig. 2b). The second infraorbital contacting only the sphenotic (see Fig. 2a) promptly distinguishes *C. lymnades* from *C. garbei* (see Fig. 2c).

The well-developed expansion of the first infraorbital bone of *C. lymnades* (Fig. 2a) corresponds to the state 3 of character 15 of Britto's (2003) phylogeny, a synapomorphy of the species located in clade IX. This clade is composed of species previously allocated in *Brochis*, in addition to *C. aeneus*, *C. eques*, *C. rabauti*, and *C. zygatus*. The infraorbital 1 anterior expansion is generally oblong in *C. aeneus*, *C. eques*, *C. rabauti*, and *C. zygatus* (see Britto, 2003: fig. 5c). In *C. britskii*, *C. multiradiatus* and *C. splendens* the anterior expansion of infraorbital 1 is truncated (see Britto, 2003: fig. 5d). In *C. lymnades* the anterior expansion is clearly rounded, so as in *C. garbei*.

In addition to a different infraorbital 1 anterior expansion shape, *C. britskii*, *C. multiradiatus* and *C. splendens* present a dermal plate in contact with this bone, absent in *C. lymnades*. Serrations on posterior margin of dorsal- and pectoral-fin spines also differ clearly these species. In the three aforementioned congeners, the serrations are retrorse, like in other long-snouted species of *Corydoras*. *Corydoras lymnades* presents serrations of those spines antrorse. The presence of serrations on anterior margin of pectoral-fin spine seems unique in *Corydoras*, however this feature was observed in few specimens. Besides, the color pattern of clade IX species is quite peculiar, presenting the background color uniform with dark dorsal region, a condition conspicuously different from the blotchy pattern of the new species.

The inclusion of *C. lymnades* in the data matrix of Britto (2003) recovered it in a consensus hypothesis as sister-group of *C. flaveolus*, and both close related to *C. paleatus*, formerly included in the basal polytomy in Britto (2003). The only synapomorphy of this clade is the absence of a process in the posterior expansion of epibranchial 2 (Britto, 2003: character 26, state 1). Nevertheless, the monophyly of the clade composed by the new species and *C. flaveolus* is corroborated by three synapomorphies (a long anterior projection of the frontal bone: Britto, 2003: character 5, state 1; process on the anterolateral margin of frontal bone: character 7, state 1; inner expansion of infraorbital 1 large: character 16, state 1). Surely the color pattern and external morphology of *C. lymnades* and *C. flaveolus* are very similar but quite different from *C. paleatus*, which presents large dark blotches in midline of flank (*vs*. smaller dark blotches) and robust and larger body (*vs*. slender and smaller body). Furthermore, *C. paleatus* is similar to several other congeners placed in different branches in Britto's (2003) hypothesis, like *C. ehrhardti*, both recovered in a basal polytomy.

A recent published study about mimetic lineages in *Corydoras* performed by Alexandrou *et al*. (2011) shows relations and patterns among co-mimics of certain regions.

That paper recovered *C. ehrhardti* and *C. paleatus* belonging to the same lineage (lineage 6) and both included in an assemblage close to *C. flaveolus* (Alexandrou *et al*., 2011: suppl. fig. 2). The insertion of *Corydoras lymnades* in Britto's (2003) data matrix also recovered *C. ehrhardti*, *C. paleatus* and *C. flaveolus* as closely related in some of the fundamental trees. Despite the major external similarity between the new species and *C. flaveolus*, *C. lymnades* and *C. paleatus* share an uncommon feature among the Corydoradinae, the posterior portion of mesethmoid externally visible, covered just by a thin skin layer. That character was not examined in the phylogenetic hypothesis proposed by Britto (2003). In fact, *Corydoras* still possess poorly known interrelations (Britto *et al*., 2007) and the presence of homoplastic color patterns (see Alexandrou *et al*., 2011) allied to the huge number of species makes the comprehension of the group systematic state difficult.

Material examined. A list of the comparative material is available in Britto (2003). In addition, the following material was examined: **Argentina**: *Corydoras longipinnis*: AI 221, holotype, 59.5 mm SL, Río Sali. **Brazil**: *C. carlae*: NUP 4875, 3, 43.8-50.1 mm SL, rio Tormenta. *C. cochui*: MZUSP 89055, 6, 18.7-23.6 mm SL, rio do Peixe 2. *C. difluviatilis*: MCP 16994, 23, 25.7-41.6 mm SL, 2 c&s, 37.9-39.1 mm SL, Bocaiúva. MCP 28500, 29, 22.0-45.1 mm SL, 2 c&s, 24.9-45.1 mm SL, tributary to rio Paranaíba. NUP 1105, 37, 16.0-36.8 mm SL, Corumbá reservoir. NUP 9966, 27, 28.4-34.3 mm SL, rio Guarda-Mor. *C. ehrhardti*: NUP 11255, 15, 36.5-46.8 mm SL, rio São Pedro. *C. ellisae*: NUP 3239, 21.0-47.8 mm SL, córrego Forquilha. *C. flaveolus*: MZUSP 47925, 13 of 20, 29.9-37.5 mm SL, 2 c&s, 29.9-33.5 mm SL, rio Baurú. NUP 84, 2, 25.6-30.0 mm SL, rio Alambari. *C. garbei*: MCP 16942, 28, 24.0-34.8 mm SL, arroio sem nome. MCP 16993, 27, 25.3-37.2 mm SL, 3 c&s, 27.6-31.9 mm SL, rio Pau da Colher. *C. latus*: NUP 12593, 21, 38.7-51.2 mm SL, tributary to rio Miranda. *C. multimaculatus*: MSL 29025, 2, 20.1-25.4 mm SL, rio Peruaçu. *C. semiaquilus*: CAS 155939 (SU 55939), holotype, 59.9 mm SL, igarapé Preto. *C. splendens*: NUP 10194, 6, 57.8-60.8 mm SL, lagoa do Poço. *C. steindachneri*: MCP 16597, 2, 32.2-37.9 mm SL, sanga em Mude-Baixa. **Guyana**: *C. potaroensis*: CAS 24754 (IU 11984), lectotype, 35.9 mm SL, creek below Potaro Landing. **Peru**: *C. fowleri*: CAS 116115, holotype, 65.1 mm SL, Caño del Chancho. **Suriname:** *C. coppenamensis*: USNM 225537, 3 of 4, 33.6-37.3 mm SL, 1 c&s, 34.5 mm SL, about 200 m upriver of Dalbana Creek mouth. *C. guianensis*: CAS 14504 (ZMA 105.837), paratypes, 2, 19.8-39.3 mm SL, creek on right bank 12.5 km WSW of Stondansie Fall. **Venezuela:** *C. bondi*: SU 35065, holotype, 33.1 mm SL, Río Yuruari. *C. concolor*: SU 54131, holotype, 42.3 mm SL, tributary to Río Parguazas. **South America**: *C. sychri*: CAS 151295, holotype, 36.4 mm SL, unknown locality - aquarium specimen.

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Literature Cited

ANA (Agência Nacional de Águas). 2012. Bacias Hidrográficas, Região Hidrográfica do São Francisco. Available from http://www2.ana.gov.br/Paginas/portais/bacias/SaoFrancisco.aspx (accessed in 10 September 2012).

Alexandrou, M. A., C. Oliveira, M. Maillard, R. A. R. McGuill, J. Newton, S. Creer & M.I., Taylor. 2011. Competition and phylogeny determine community structure in Müllerian co-mimics. Nature, 469: 84-88.

Aquino, A. E. & S. A. Schaefer. 2002. The temporal region of the cranium of loricarioid catfishes (Teleostei: Siluriformes): Morphological diversity and phylogenetic significance. Zoologischer Anzeiger, 241: 223-244.

Arratia, G. & M. Gayet. 1995. Sensory canals and related bones of tertiary siluriform crania from Bolivia and North America and comparison with recent forms. Journal of Vertebrate Paleontology, 15: 482-505.

Britto, M. R. 2003. Phylogeny of the subfamily Corydoradinae Hoedeman, 1952 (Siluriformes: Callichthyidae), with a definition of its genera. Proceedings of the Academy of Natural Sciences of Philadelphia, 153: 119-154.

Britto, M. R. & F. C. T. Lima. 2003. *Corydoras tukano*, a new species of corydoradine catfish from the rio Tiquié, upper rio Negro basin, Brazil (Ostariophysi: Siluriformes: Callichthyidae). Neotropical Ichthyology, 1: 83-92.

Britto, M. R., F. C. T. Lima & M. H. Hidalgo. 2007. *Corydoras ortegai* a new species of corydoradine catfish from the lower río Putumayo in Peru (Ostariophysi: Siluriformes: Callichthyidae). Neotropical Ichthyology, 5: 293-300.

Britto, M. R., W. B. Wosiacki & L. F. A. Montag. 2009. A new species of Corydoradinae catfish (Ostariophysi: Siluriformes: Callichthyidae) from Rio Solimões Basin, Brazil. Copeia, 2009: 684-689.

Eschmeyer, W. N. 2012. Catalog of Fishes. Available from http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (accessed 10 Sep 2012)

Ferraris, C. J., Jr. 2007. Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types. Zootaxa, 1418: 1-300.

Goloboff, P. A., J. S. Farris & K. C. Nixon. 2008. TNT, a free program for phylogenetic analysis. Cladistics, 24: 774-786.

Gosline, W. A. 1940. A revision of the Neotropical catfishes of the family Callichthyidae. Stanford Ichthyological Bulletin, 2: 1-36.

Nijssen, H. 1970. Revision of the Surinam catfishes of the genus *Corydoras* Lacépède, 1803 (Pisces, Siluriformes, Callichthyidae). Beaufortia, 18: 1-75.

Nijssen, H. & I. J. H. Isbrücker. 1980. A review of the genus *Corydoras* Lacépède, 1803 (Pisces, Siluriformes, Callichthyidae). Bijdrague Dierkunde, 50: 190-220.

Reis, R. E. 1997. Revision of the Neotropical genus *Hoplosternum* (Ostariophysi: Siluriformes: Callichthyidae) with the description of two new genera and three new species. Ichthyological Exploration of Freshwaters, 7: 299-326.

Reis, R. E. 1998. Anatomy and phylogenetic analysis of the Neotropical callichthyid catfishes (Ostariophysi, Siluriformes). Zoological Journal of the Linnaean Society, 124: 105-168.

Reis, R. E. 2003. Family Callichthyidae (armored catfishes). Pp. 291-309. In: Check List of the Freshwater Fishes of South and Central America. R. E. Reis, S. O. Kullander, & C. J. Ferraris, Jr. (Eds.). Porto Alegre, Edipucrs, 729p.

Taylor, W. R. & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium, 9: 107-119.

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