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LUIZ FERNANDO CASERTA TENCATT

**The *Aspidoras* Ihering, 1907 (Siluriformes: Callichthyidae) armored
catfishes: a taxonomic review, with description of a new species**

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LUIZ FERNANDO CASERTA TENCATT

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Tese apresentada ao Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais do Departamento de Biologia, Centro de Ciências Biológicas da Universidade Estadual de Maringá, como requisito parcial para obtenção do título de Doutor em Ciências Ambientais.

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Orientadora: Dr.^a Carla Simone Pavanelli

Coorientador: Prof. Dr. Marcelo Ribeiro de Britto

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Os cascudos *Aspidoras* Ihering, 1907 (Siluriformes: Callichthyidae): uma revisão taxonômica, com a descrição de uma espécie nova

RESUMO

Aspidoras foi descrito por Ihering como um gênero monotípico para abrigar *A. rochai*. Atualmente, o gênero inclui 24 espécies válidas, sendo relativamente bem distribuído ao longo do território brasileiro, ocorrendo de São Paulo, seu registro mais ao sul, até o Ceará. Após a primeira revisão taxonômica fornecida por Nijssen & Isbrücker 40 anos atrás, nenhum trabalho extensivo com o objetivo de elucidar a taxonomia de *Aspidoras* foi conduzido. Uma revisão taxonômica abrangente foi realizada para o reconhecimento claro do gênero através de uma nova diagnose, que inclui uma possível característica exclusiva, a presença de pequenas expansões laminares na base dos raios ramificados da nadadeira peitoral. Considerando a nova diagnose e os dados filogenéticos disponíveis atualmente, *A. pauciradiatus* e *A. virgulus* foram excluídas de *Aspidoras*, sendo transferidas para *Corydoras* e *Scleromystax*, respectivamente. A respeito das demais espécies, algumas sinonímias novas são propostas: *A. eurycephalus* e *A. taurus* com *A. albater*; *A. menezesi* e *A. spilotus* com *A. raimundi*; e *A. microgaleus* e *A. marianae* com *A. poecilus*. Adicionalmente, uma espécie nova das bacias dos rios Araguaia e Paraguai no estado do Mato Grosso é descrita. A espécie nova pode ser distinguida de suas congeneres por apresentar a combinação de duas características: parapófise do complexo de vértebras bem desenvolvido, e porção anterior do infraorbital 1 com expansão laminar pouco desenvolvida, ligeiramente ultrapassando a margem posterior da cápsula nasal. Assim, o número de espécies válidas em *Aspidoras* foi reduzido de 24 para 17. Redescrições para *A. albater*, *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. lakoi*, *A. maculosus*, *A. poecilus*, *A. psammatides*, *A. raimundi* e *A. velites* foram fornecidas. Uma chave de identificação englobando as espécies de *Aspidoras*, com exceção de *A. carvalhoi*, também é fornecida.

Palavras chave: Aspidoradini. Corydoradinae. Neotropical. Osteologia. Taxonomia.

The *Aspidoras* Ihering, 1907 (Siluriformes: Callichthyidae) armored catfishes: a taxonomic review, with description of a new species

ABSTRACT

Aspidoras was described by Ihering as a monotypic genus to harbour *A. rochai*. Currently, the genus comprises 24 valid species, and is relatively well distributed across the Brazilian territory, occurring from São Paulo, its southernmost record, to Ceará. After its first taxonomic review provided by Nijssen & Isbrücker 40 years ago, no extensive work aiming to elucidate the taxonomy of *Aspidoras* was conducted. Therefore, a comprehensive taxonomic review was carried out, allowing the clear recognition of the genus through a new diagnosis that includes a possible exclusive feature, the presence of small laminar expansions on base of the pectoral-fin branched rays. Considering the new diagnosis plus the currently available phylogenetic data, *A. pauciradiatus* and *A. virgulatus* are herein excluded from *Aspidoras*, being transferred to *Corydoras* and *Scleromystax*, respectively. Regarding the remaining species, some new synonymies are proposed: *A. eurycephalus* and *A. taurus* with *A. albater*; *A. menezesi* and *A. spilotus* with *A. raimundi*; and *A. microgaleus* and *A. marianae* with *A. poecilus*. Additionally, a new species from the rivers Araguaia and Paraguay basins in Mato Grosso State is described. The new species can be distinguished from its congeners by having the combination of two features: parapophysis of the complex vertebra well developed, and anterior portion of infraorbital 1 with poorly-developed laminar expansion, slightly surpassing posterior margin of nasal capsule. Thereby, the number of valid species within *Aspidoras* was reduced from 24 to 17. Redescriptions for *A. albater*, *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. lakoi*, *A. maculosus*, *A. poecilus*, *A. psammattides*, *A. raimundi* and *A. velites* are provided. An identification key encompassing the species of *Aspidoras*, with exception of *A. carvalhoi*, is also provided.

Keywords: Aspidoradini. Corydoradinae. Neotropical. Osteology. Taxonomy.

ADVERTÊNCIA

Esta tese de doutorado não constitui uma publicação científica formal. Consequentemente, os novos dados, opiniões e hipóteses aqui apresentados não estão disponíveis na literatura zoológica. Por este trabalho não ser considerado uma publicação formal segundo as normas do Código Internacional de Nomenclatura Zoológica, o epíteto específico da espécie nova é omitido, a qual é provisoriamente tratada como *Aspidoras* sp.

Tese elaborada e formatada conforme as normas da publicação científica *Zootaxa*.
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1 THE *ASPIDORAS* IHERING, 1907 (SILURIFORMES: CALLICHTHYIDAE) ARMORED CATFISHES: A TAXONOMIC REVIEW, WITH DESCRIPTION OF A NEW SPECIES

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extensivo com o objetivo de elucidar a taxonomia de *Aspidoras* foi conduzido. Portanto, uma revisão taxonômica abrangente foi realizada, permitindo o reconhecimento claro do gênero através de uma nova diagnose, que inclui uma possível característica exclusiva, a presença de pequenas expansões laminares na base dos raios ramificados da nadadeira peitoral. Considerando a nova diagnose mais os dados filogenéticos disponíveis atualmente, *A. pauciradiatus* e *A. virgulatus* foram aqui excluídas de *Aspidoras*, sendo transferidas para *Corydoras* e *Scleromystax*, respectivamente. A respeito das demais espécies, algumas sinonímias novas são propostas: *A. eurycephalus* e *A. taurus* com *A. albater*; *A. menezesi* e *A. spilotus* com *A. raimundi*; e *A. microgaleus* e *A. marianae* com *A. poecilus*. Adicionalmente, uma espécie nova das bacias dos rios Araguaia e Paraguai no estado do Mato Grosso é descrita. A espécie nova pode ser distinguida de suas congeneres por apresentar a combinação de duas características: parapófise do complexo de vértebras bem desenvolvido, e porção anterior do infraorbital 1 com expansão laminar pouco desenvolvida, ligeiramente ultrapassando a margem posterior da cápsula nasal. Assim, o número de espécies válidas em *Aspidoras* foi reduzido de 24 para 17. Redescrições para *A. albater*, *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. lakoi*, *A. maculosus*, *A. poecilus*, *A. psammatides*, *A. raimundi* e *A. velites* foram fornecidas. Uma chave de identificação englobando as espécies de *Aspidoras*, com exceção de *A. carvalhoi*, também é fornecida.

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1.1 INTRODUCTION

The Callichthyidae armoured catfishes can be promptly distinguished from all other Siluriformes by the presence of two longitudinal series of dermal plates on flanks (Reis, 2003). The family currently consists of around 200 valid species and is composed by eight genera (Reis, 2003; Eschmeyer, 2017). *Aspidoras*, its second largest genus, was described by Ihering (1907) as a monotypic genus harboring his new species, *A. rochai*. According to Ihering (1907: 30) the genus is recognized by the presence of the following unique combination of features: (I) two pairs of dorsolateral body plates between the parieto-supraoccipital and dorsal-fin base anterior origin; (II) parieto-supraoccipital nearly hexagonal, with poorly developed posterior process of the parieto-supraoccipital; (III) head conspicuously deep, not depressed, rounded anteriorly and slightly laterally compressed; (IV) scapulocoracoid entirely covered by skin on ventral portion of the body; (V) barbels short, not reaching anteroventral limit of gill opening.

Gosline (1940), in his revisionary study of the Callichthyidae, proposed a new diagnosis for *Aspidoras* based on the presence of the following combination of features: (I) head compressed; (II) lower lip reverted, forming a single pair of barbels, besides the outer mental barbel; (III) outer mental barbel reaching region of anteroventral limit of gill opening; (IV) eye slightly elevated; (V) infraorbital I naked (possibly meaning exposed); (VI) fontanel small, roundish, its size nearly equal to half of the bony orbit diameter; (VII) posterior process of the parieto-supraoccipital short and broad; (VIII) dorsolateral body plates touching their counterparts between the posterior process of the parieto-supraoccipital and nuchal plate; (IX) region of pectoral girdle entirely covered by skin; (X) dorsal fin I,7, its base slightly shorter than distance between dorsal and adipose fins; and (XI) caudal fin forked (Gosline, 1940: 10). Despite the 33 years apart between the description of *Aspidoras* and Gosline's work, *A. rochai* was its only valid species until then. The designation of a lectotype for *A. rochai* came after 62 years of its description, by Britski (1969: 206)

Nijssen & Isbrücker (1976) presented the first comprehensive taxonomic review of *Aspidoras*, comprising a total of 13 species, the already valid *A. rochai* and *A. lakoi* Miranda Ribeiro, 1949, *Corydoras raimundi* Steindachner, 1907 and *Corydoras pauciradiatus* Weitzman & Nijssen, 1970, both transferred to *Aspidoras* by them, and also nine new species, *A. albater*, *A. brunneus*, *A. carvalhoi*, *A. eurycephalus*, *A. fuscoguttatus*, *A. maculosus*, *A. menezesi*, *A. poecilus* and *A. spilotus*. Additionally, the authors recognized a 14th morphotype, which they called *Aspidoras* aff. *poecilus*, however its formal description was not presented, probably due to the exclusive presence of badly preserved specimens (Nijssen & Isbrücker, 1976: 129). Nijssen & Isbrücker (1976: 109) also provided a new diagnosis for the genus, distinguishing *Aspidoras* from the other genera of Callichthyidae by the presence of two cranial fontanels, the posterior one in the parieto-supraoccipital and the anterior one between frontals (vs. a single fontanel). After Nijssen & Isbrücker's work (1976), no extensive work aiming to elucidate the taxonomy of *Aspidoras* was conducted.

Subsequent to Nijssen & Isbrücker's (1980a) description of *Aspidoras virgulatus*, the taxonomy of the group was neglected for almost 20 years, when Britto (1998) proposed two new species for *Aspidoras*, *A. belenos*, from the rio Araguaia basin, and *A. microgalaeus*, from the rio Xingu basin. The descriptions showed a great improvement over the previous descriptions, furnishing external morphology data plus osteological data, which was used in the diagnosis of both new species. The diagnosis of *A. belenos* was the first to include the morphology of an infraorbital bone, which has proven to be extremely useful for the recognition

of the Corydoradinae species (e.g. Tencatt *et al.* 2013; Tencatt *et al.*, 2014; Britto *et al.*, 2016; Tencatt & Britto, 2016; Ohara *et al.*, 2016). After this work, six species were subsequently described, *A. depinnai* Britto, 2000, *A. taurus* Lima & Britto, 2001, *A. velites* Britto, Lima & Moreira, 2002, *A. psammatides* Britto, Lima & Santos, 2005, *A. gabrieli* Wosiacki, Pereira & Reis, 2014 and *A. marianae* Leão, Britto & Wosiacki, 2015, totaling 22 species for the genus.

The phylogenetic relationships within *Aspidoras* are also poorly known. Reis (1998) provided the first phylogenetic information about *Aspidoras*, finding it monophyletic and as the sister-group of a clade composed by *Corydoras* and *Brochis*. This author also provided a diagnosis for the genus (see Reis, 1998: 161), which consisted in the presence of three features: (I) fontanel on parieto-supraoccipital, (II) reduced ossified portion of pectoral- and dorsal-fin spines, and (III) absence of contact between nuchal plate and posterior process of the parieto-supraoccipital. Britto (2003), in his morphological phylogenetic for the Corydoradinae, corroborated the monophyly of *Aspidoras* and also proposed a new diagnosis for the genus based on the presence of the following synapomorphies: (I) posterior portion of mesethmoid wide, (II) frontal fontanel reduced, (III) supraoccipital fontanel present, (IV) opercle compact, and (V) ossified portion of pectoral spine strongly reduced, less than half the length of the first branched pectoral-fin ray. Additionally, Britto (2003) mentioned that *Aspidoras* generally presents relatively smaller eyes in relation to the other Corydoradinae and, excepting for *A. belenos*, absence of contact between the posterior process of the parieto-supraoccipital and the nuchal plate.

Shimabukuro-Dias *et al.* (2004) published a phylogenetic study of the Callichthyidae, based mainly on molecular data but also combining their data with the morphological data provided by Reis (1998). Their results showed *Aspidoras* species in a monophyletic clade along with *Scleromystax macropterus* in most consensus trees, the two exceptions were maximum-parsimony trees generated by weighing morphological data five times the molecular data, in which *Aspidoras* species were grouped alone in a monophyletic clade sister-grouping *S. macropterus*, and by weighing morphological data ten times the molecular data, showing the *Aspidoras* species were grouped alone in a monophyletic clade sister group of the remaining Corydoradinae. The most recent phylogenetic hypothesis including *Aspidoras* was presented by Alexandrou *et al.* (2011) and, contrary to the previous studies, the genus appeared as paraphyletic, with *A. pauciradiatus* within lineage 5, the ‘*Corydoras elegans* group’ clade (for further comments about this group see Tencatt & Pavanelli, 2015), and not lineage 2, the *Aspidoras* clade. The paraphyly of *Aspidoras* was also found in the unpublished phylogenetic

hypothesis presented by Vera-Alcaraz (2013), in which *A. virgulatus* appeared within the *Scleromystax* clade. However, despite the numerous attempts to provide an accurate diagnosis to the genus (Ihering, 1907; Gosline, 1940; Nijssen & Isbrücker, 1976; Reis, 1998; Britto, 2003; Vera-Alcaraz, 2013), the clear recognition of *Aspidoras* is still dubious and needs further investigation (Weitzman & Balph, 1979).

Considering that the recognition of the genus is still unclear and the unique available taxonomic review of *Aspidoras* was published over 40 years ago, based mainly on old and badly preserved specimens, in addition to the relatively large number of species described subsequent to Nijssen & Isbrücker's (1976) work, a new comprehensive taxonomic review becomes necessary. After the gathering of several specimens from many localities it was possible to clearly delimit *Aspidoras* and recognize most of its species, including a new one, which is described herein. A new diagnosis for *Aspidoras* is proposed, as well as the reallocation of *A. pauciraditus* in *Corydoras* and of *A. virgulatus* in *Scleromystax*. Resdescriptions for *A. albater*, *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. lakoi*, *A. maculosus*, *A. poecilus*, *A. psammatides*, *A. raimundi* and *A. velites*, along with an identification key, are provided.

1.2 MATERIAL AND METHODS

Measurements were obtained using digital caliper to the nearest tenth of millimeter. Morphometric data was obtained as illustrated in Figure 1. Meristica data was taken following Reis (1997). Morphometrics are reported as proportion of standard length (SL) or as proportions of head length (HL). Homology of barbels follows Britto & Lima (2003). For the osteological analysis, some specimens were cleared and stained (CS) according to the protocol of Taylor & Van Dyke (1985). Osteological terminology was based on Reis (1998), except by using parieto-supraoccipital instead of supraoccipital (Arratia & Gayet, 1995), compound pterotic instead of pterotic-supracleithrum (Aquino & Schaefer, 2002), and scapulocoracoid instead of coracoid (Lundberg, 1970). Nomenclature of latero-sensory canals and preopercular pores are according to Schaefer & Aquino (2000) and Schaefer (1988), respectively. The supra-preopercle *sensu* Huysentruyt & Adriaens (2005) were treated here as a part of the hyomandibula according to Vera-Alcaraz (2013). Vertebral counts include only free centra, with the compound caudal centrum (preural 1+ ural 1) counted as a single element. In the description, numbers in parenthesis represent the total number of specimens with those counts. Numbers with an asterisk refer to the counts of the primary types. The photographs of primary type specimens of *Aspidoras albater* (lateral view), *A. brunneus*, *A. depinnai* (lateral view), *A. fuscoguttatus* (lateral view), *A. maculosus*, *A. microgalaeus* (lateral view), *A. poecilus*, *A. rochai* (lateral

view), *A. spilottus* and *A. taurus* (lateral view) were obtained from Morris *et al.* (2006). Institutional abbreviations follow Sabaj (2016).

1.3 RESULTS

Aspidoras Ihering, 1907

Aspidoras Ihering, 1907: 30–31 (original description; type-species: *Aspidoras rochai* Ihering, 1907, by original designation and monotypy). –Nijssen & Isbrücker, 1976: 107–131 (taxonomic review). –Reis, 1998: 161 (diagnosis in identification key). –Britto, 2003: 144, 146–147 (phylogeny; diagnosis). –Reis, 2003: 291 (listed). –Ferraris, 2007: 108 (listed).

Diagnosis. *Aspidoras* can be distinguished from *Corydoras* and *Scleromystax* by presenting an exclusive feature among Corydoradinae: base of pectoral-fin branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins, forming pointed structures, in some specimens (*vs.* absence). Additionally, *Aspidoras* can be distinguished from *Corydoras* and *Scleromystax*, with exception of *Corydoras pauciradiatus*, renewed, original combination, *C. lacerdai* and *S. virgulatus*, by having parieto-supraoccipital fontanel (*vs.* fontanel absent); from *C. pauciradiatus*, *C. lacerdai* and *S. virgulatus* by presenting conspicuously less developed pectoral spine (*vs.* conspicuously more developed).

Sexual dimorphism. Except for the presence of lanceolate genital papillae in males, presented by all Corydoradinae (see Nijssen & Isbrücker, 1980a; Britto, 2003), no other conspicuous sexually dimorphic feature was observed.

Remarks. After the examination of *Aspidoras pauciradiatus* from the Branco and Negro river basins, it was possible to conclude that, despite the presence of the parieto-supraoccipital fontanel, *A. pauciraditus* is much more related to the *Corydoras* from the lineage 5 than *Aspidoras* based on the presence of the following features: (I) pectoral-fin spine well developed (*vs.* spine clearly less developed); (II) eyes conspicuously larger (*vs.* conspicuously smaller); and (III) base of pectoral-fin branched rays lacking small laminar expansions on its inner margin (*vs.* presenting). Therefore, since both morphological and molecular (see Alexandrou *et al.*, 2011: suppl. fig. 2) evidence supports the close relation between *A. pauciradiatus* and the

Corydoras species from the lineage 5, the most reasonable decision is to replace this species in *Corydoras*, as originally proposed by Weitzman & Nijssen (1970).

Calviño & Alonso (2009) provided the description of two new species of *Corydoras*, *C. gladysae* and *C. petracinii*, and the redescription of *C. micracanthus*, proposing the “*C. micracanthus* group”, which only includes these three species. The authors also discussed the similarity between the general morphological pattern of the species from the *C. micracanthus* group and *Aspidoras*, such as short ossified portion of dorsal- and pectoral-fin spines and conspicuously slender body (see Calviño & Alonso, 2009: 210). However, the authors refuted the possible allocation of these species in *Aspidoras*, mainly by the absence of the parieto-supraoccipital fontanel, which is present in all *Aspidoras*. After the examination of *C. micracanthus* and *C. gladysae* specimens, it was possible to confirm that these species are not compatible with *Aspidoras*, not only by the absence of the parieto-supraoccipital fontanel but also by lacking the small laminar expansions on bases of first pectoral-fin branched rays, an apparently exclusive feature of the genus.

***Aspidoras* sp., new species**

(Fig. 2)

Aspidoras taurus (*non* Lima & Britto, 2001): –Lima & Britto, 2001: 1011 (paratypes of *Aspidoras taurus*; *partim*).

Holotype. MNRJ uncataloged, 30.0 mm SL, Brazil, Mato Grosso State, Alto Araguaia Municipality, córrego do Sapo, upstream the Couto de Magalhães Waterfall, rio Araguaia basin, 17°31'10"S 53°15'31"W, 7–8 Aug 2002, A. L. A. Melo & L. S. F. Martins.

Paratypes. All from Brazil, Mato Grosso State, Alto Araguaia Municipality. CPUFMT 700, 11, 21.5–28.8 mm SL, córrego Pinguelinha, rio Paraguay basin, 17°19'17"S 53°34'55"W, 18 Nov 2010, F. Machado & A. Ribeiro. CPUFMT 703, 3, 15.1–29.7 mm SL, córrego Pinguela, rio Paraguay basin, 17°18'37"S 53°32'23"W, 18 Nov 2010, F. Machado & A. Ribeiro. CPUFMT 724, 1, 15.7 mm SL, córrego São José, rio Paraguay basin, 17°26'26"S 53°37'44"W, 18 Nov 2010, F. Machado & A. Ribeiro. LIRP 4437, 24 of 46, 10.6–30.5 mm SL, 2 CS of 46, 25.0–25.6 mm SL; LIRP 4494, 13 of 29, 14.7–27.6 mm SL, 2 CS of 29, 26.0–27.0 mm SL, collected with the holotype. LIRP 4477, 1, 23.7 mm SL, rio Araguaia, rio Araguaia basin, 17°19'42"S 53°12'58"W, 5–7 Aug 2002, A. L. A. Melo & L. S. F. Martins. MZUSP 41404, 22, 15.1–22.6 mm SL, córrego do Rancho, 17°15'0"S 53°23'0"W, 8 Mar 1989, L.P.S. Portugal & F. Langeani. MZUSP 41417, 2, 19.2–27.1 mm SL, córrego da Pinguela, 17°19'S 53°14'W,

9 Mar 1989, L.P.S. Portugal & F. Langeani. MZUSP 41488, 2, 27.2–27.4 mm SL, córrego do Mato, 17°19'S 53°14'W, 9 Mar 1989, L.P.S. Portugal & F. Langeani. MZUSP 73248, 1, 16.3 mm SL, córrego Gordura, 17°18'20"S 53°16'22"W, 15 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73278, 8, 10.4–33.1 mm SL, stream tributary to the córrego Gordura, 17°17'55"S 53°16'34"W, 17 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73261, 6, 15.7–22.8 mm SL, stream tributary to the córrego Gordura, 17°19'2"S 53°15'49"W, 16 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73265, 24, 10.5–25.0 mm SL, córrego Boiadeiro, 17°20'1"S 53°14'52"W, 16 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73283, 1, 12.1 mm SL, stream tributary to the córrego Gordura, 17°17'42"S 53°17'12"W, 17 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73293, 4, 14.3–22.7 mm SL, stream tributary to the córrego Boiadeiro, 17°20'31"S 53°14'41"W, 18 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73302, 3, 22.1–31.7 mm SL, stream tributary to the córrego Tapera, 17°21'58"S 53°14'51"W, 18 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73306, 1, 19.0 mm SL, córrego Tapera, 17°22'19"S 53°14'30"W, 18 May 2001, C.L.R. Moreira & F.C.T. Lima. MZUSP 73331, 6, 12.3–18.0 mm SL, córrego do Sapinho, 17°25'35"S 53°14'20"W, 21 May 2001, C.L.R. Moreira & F.C.T. Lima.

Diagnosis. *Aspidoras* sp. can be distinguished from its congeners, with exception of *A. belenos*, *A. kiriri* and *A. raimundi*, by having parapophysis of the complex vertebra well developed (*vs.* moderately developed in *A. depinnai*, *A. lakoi*, *A. maculosus*, *A. mephisto*, *A. poecilus*, *A. psammatides* and *A. velites*; poorly or moderately developed in *A. albater* and *A. fuscoguttatus*); it can be distinguished from *A. belenos*, *A. kiriri* and *A. raimundi* by having inner laminar expansion of infraorbital 1 ranging from well developed to extremely well developed (*vs.* moderately developed). Additionally, it can be distinguished from *A. albater*, *A. gabrieli*, *A. lakoi*, *A. mephisto*, *A. psammatides* and *A. rochai* by having a narrow frontal bone, with width slightly smaller than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length in *A. albater*, *A. gabrieli*, *A. lakoi*, *A. mephisto* and *A. rochai*; strongly narrow, with width conspicuously smaller than half of entire length in *A. psammatides*); from *A. depinnai* and *A. kiriri* by the presence of small black spots on dorsal fin (*vs.* absence).

Description. Morphometric data presented in Table 1. Head compressed with convex dorsal profile; somewhat trapezoid in dorsal view. Snout moderately developed and pointed; relatively well-developed in some specimens. Head profile convex from tip of snout to anterior nares; region of mesethmoid slightly concave in some specimens; ascending slightly convex from this point to dorsal-fin origin. Dorsal margin of orbit slightly elevated in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or slightly smaller than naris diameter. Mouth small, subterminal, width slightly larger than bony orbit diameter. Maxillary barbel moderate in size, not reaching anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base slightly separated from its counterpart. Lower lip moderately developed, forming small semicircular or triangular fleshy flap. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip poorly developed, slightly smaller than 50% of bone length (see Britto, 2003: 123, character 1, state 1; fig. 1B); posterior portion wide, partially exposed. Nasal slender, curved laterally, inner margin with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border contacting frontal and mesethmoid.

Frontal elongated, narrow, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection ranging from short, with size smaller than nasal length, to long, with size slightly larger than nasal length; anterior margin generally exposed. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal

anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process strongly reduced to poorly developed, not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; expanded posteriorly in some specimens, slightly surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion poorly to moderately developed; anterior portion with laminar expansion ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule (Fig. 4); inner laminar expansion ranging from well developed to extremely well developed (see Fig. 5a,b); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion generally poorly developed; inner laminar expansion ranging from moderately- to well developed; posteroventral margin close but not directly contacting posterodorsal ridge of hyomandibula; contacting in some specimens; dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 4). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thick layer of skin; exposed areas generally bearing small odontodes. Interopercle entirely covered by thick layer of skin; with posterior portion exposed in some specimens; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with strongly reduced process on anterior margin of mesial portion; absent in some specimens; ceratobranchial 3 with continuous

postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 20 to 26 (4) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with strongly reduced pointed process on laminar expansion of posterior margin; absent in some specimens; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens. Upper tooth plate oval; 23 to 31 (4) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel; slightly shorter; pore opening closer to supraorbital main canal in some specimens. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore generally fused with first pore. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two or three pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,7 (1), II,8* (19), posterior margin of dorsal-fin spine smooth. Nuchal plate moderately developed in length; almost entirely exposed, with minute odontodes on exposed area; anterior tip covered by thick layer of skin (Fig. 6); spinelet short, partially exposed; spine relatively well developed, adpressed distal tip reaching to or surpassing posterior origin of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,7 (1), I,8* (19); posterior margin of pectoral spine with 21 to 27 moderately-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in

some specimens; base of branched rays with reduced laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 7). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third ventrolateral body plate, and at vertical through second dorsal-fin branched ray. Pelvic-fin rays i,5* (20). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by seven or eight dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 12th or 13th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin rays, ii,5 (3), ii,4,i (2), ii,6 (2), ii,5,i* (13). Caudal-fin rays i,11,i (1), i,12,i* (19), four or five dorsal and/or ventral procurrent rays; bilobed; dorsal and ventral lobes generally with similar size; dorsal lobe slightly larger than ventral lobe in some specimens.

Two or three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal, if present, encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 24 (5), 25* (12), 26 (3); ventrolateral body plates 21 (1), 22* (13), 23 (6); dorsolateral body plates along dorsal-fin base 5 (2), 6* (15), 7 (3); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (13), 8* (7); preadipose platelets 2 (2), 3* (8), 4 (9), 5 (1); 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. Ventral surface of trunk naked.

Vertebral count 23 (4); ribs 6 (3), 7(1), first pair conspicuously large; parapophysis of complex vertebra well developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; generally forming dark brown or black rounded, striated or irregular relatively large spots; or forming conspicuously smaller spots; generally, with dark brown or black diffuse or conspicuous stripe from anteroventral portion of eye to upper lip lateral area; ventrolateral portion of snout with dark brown or black chromatophores, variably forming spots, in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip

generally with conspicuous concentration of dark brown or black chromatophores; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion; region of isthmus around lower lip with dark brown or black chromatophores in some specimens. Dorsal series of four to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third, if present, between dorsal and adipose fins, fourth on adipose-fin base, and fifth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk, generally on region close to pectoral- and pelvic-fin origins, and region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral body plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of three to six medium-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; blotches fused, forming longitudinally elongated bars in some specimens. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, between dorsal and adipose fins, adipose-fin base, and base of caudal peduncle with more concentrated chromatophores, forming conspicuous blotches in some specimens; fused to flank midline blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores, generally forming conspicuous blotches; blotches generally more evident posteriorly to pelvic-fin origin; fused to flank midline blotches in some specimens; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming oblique bars in some specimens; membranes with dark brown or black chromatophores, generally more evident on region of first and second branched rays proximal portion; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and branched rays;

conspicuous concentration of dark brown and black chromatophores on proximal portion of branched rays; covered by dark brown or black spots in some specimens; spots aligned, forming oblique bars in some specimens; spots diffuse or more evident on first branched rays in some specimens; region of body around dorsal portion of pectoral-fin origin generally with concentration of dark brown or black chromatophores. Pelvic fin with conspicuous concentration of dark brown or black chromatophores on its dorsal surface, generally forming one to three oblong dark brown or black patches; anteriormost patch generally larger and more intensely pigmented; region of body around dorsal portion of pelvic-fin origin with concentration of dark brown or black chromatophores in some specimens. Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; forming one to three dark brown or black blotches in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender to thick bars.

Coloration in life. Based on photos of aquarium specimens. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 8).

Geographical distribution. *Aspidoras* sp. is known from the upper rio Araguaia basin in Goiás and Mato Grosso states, and upper rio Paraguay basin in Mato Grosso State (Fig. 9a).

Remarks. The analysis of the *Aspidoras taurus* type-series revealed the presence of two species, one that included the holotype of *A. taurus*, and a second one under the vouchers MZUSP 41488, MZUSP 41404 and MZUSP 41417, which is clearly different from all congeners (see Diagnosis). Despite the authors stated that *A. taurus* only occurs in the upper rio Paraguay basin, the available data of MZUSP 41404 showed that its collecting site, the do Rancho Stream, is in fact a tributary to the upper rio Araguaia basin, and not upper rio Paraguay basin, as stated by the Lima & Britto (2001:1011).

***Aspidoras albater* Nijssen & Isbrücker, 1976**

(Fig. 10)

Aspidoras albater Nijssen & Isbrücker, 1976: 115 (original description; type-locality: rio Tocantinzinha [sic, = Tocantinzinho] near São João da Aliança, Goiás State, Brazil). –Britto, 1998: 360 (listed as comparative material; *partim*). –Britto, 2000: 1054 (listed as comparative material; *partim*). –Lima & Britto, 2001: 1015 (listed as comparative material; *partim*). –Reis, 2003: 292 (listed). –Ferraris, 2007: 108 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison, listed as comparative material). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras eurycephalus Nijssen & Isbrücker, 1976: 118 (original description; type-locality: Vermelho Stream into rio das Almas, Goiás State, Brazil; new synonym). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras poecilus (*non* Nijssen & Isbrücker, 1976): –Oliveira *et al.*, 2017: e160118[7] (listed as comparative material; *partim*).

Aspidoras aff. *poecilus* (*non* Nijssen & Isbrücker, 1976): –Britto, 1998: 361 (listed as comparative material; *partim*). –Britto, 2000: 1054 (listed as comparative material; *partim*). –Lima & Britto, 2001: 1015 (listed as comparative material; *partim*).

Aspidoras taurus Lima & Britto, 2001: 1011 (original description; type-locality: rio Itiquira, Mato Grosso State, Brazil; *partim*; new synonym). –Ferraris, 2007: 110 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison, listed as comparative material). –Tencatt & Bichuette, 2017: 21 (listed as comparative material).

Diagnosis. *Aspidoras albater* can be distinguished from its congeners, with exception of *A. depinnai*, *A. fuscoguttatus*, *A. gabrieli*, *A. lakoi*, *A. poecilus* and *Aspidoras* sp., by having inner laminar expansion of infraorbital 1 ranging from well developed to extremely well developed (*vs.* moderately developed in *A. belenos*, *A. maculosus*, *A. mephisto* and *A. raimundi*; poorly developed in *A. psammatides* and *A. velites*); it differs from *A. fuscoguttatus* by having anterior portion of infraorbital 1 with laminar expansion ranging from strongly reduced, at same level as posterior margin of nasal capsule, to moderately-developed expansion, reaching to middle of nasal capsule (*vs.* expansion ranging from well developed, surpassing middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule); from *A. gabrieli* by the presence of acutely furcate caudal fin (*vs.* smoothly furcate), and dorsolateral

body plates on predorsal region touching their counterparts or clearly closer to each counterpart (*vs.* clearly more distant from each counterpart); from *A. lakoi* it can be distinguished by lacking a pointed process on anterodorsal portion of infraorbital 1 (*vs.* presence); from *A. depinnai* and *A. poecilus* plus *A. psammatides*, *A. raimundi*, *A. velites* and *Aspidoras* sp. by having relatively wide frontal bone, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length in *A. depinnai*, *A. poecilus*, *A. raimundi*, *A. velites* and *Aspidoras* sp.; strongly narrow, with width conspicuously smaller than half of entire length in *A. psammatides*); it can be further distinguished from *A. belenos*, *A. kiriri* and *Aspidoras* sp. by having parapophysis of the complex vertebra poorly or moderately developed (*vs.* well developed).

Description. Morphometric data presented in Table 2; additional morphometric data available in Lima & Britto (2001: 1012, table I). Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout relatively well-developed and pointed; moderately developed and more rounded in some specimens. Head profile convex from tip of snout to anterior nares; region of mesethmoid slightly concave in some specimens; ascending slightly convex to nearly straight from this point to dorsal-fin origin. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave or nearly straight to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; lump on isthmus region in some specimens (apparently by malformation); region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or slightly smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming small semicircular

or triangular fleshy flap; with two triangular fleshy flaps in some specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip long, slightly larger than 50% of entire bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, entirely or almost entirely covered by thick layer of skin. Nasal slender, curved laterally, inner margin generally with moderately-developed laminar expansion; poorly developed in some specimens; outer margin with reduced laminar expansion; absent in some specimens; mesial border generally contacting only frontal; or contacting frontal and mesethmoid.

Frontal elongated, relatively wide, with width equal to or slightly larger than half of entire length (see Fig. 3b); anterior projection ranging from short, with size smaller than nasal length, to long, with size larger than nasal length; anterior margin generally covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process strongly reduced to poorly developed; not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; with posterior portion not reaching tip of posterior process in some specimens; or expanded posteriorly, surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital; slightly displaced towards posterior portion of parieto-supraoccipital in some specimens; fontanel occluded, reduced to a small fossa, in some specimens.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally ranging from poorly developed to well-developed; almost reduced to latero-sensory canal in some specimens; single specimen with extremely well-developed ventral laminar expansion (MZUSP 49853, 35.4 mm SL); anterior portion with laminar expansion ranging from strongly reduced, at same level as posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule (Fig. 11); inner laminar expansion ranging from well developed to extremely well developed (see Fig. 7a,b); small portions of

external surface covered by thick layer of skin; infraorbital 2 small, generally slender; slightly more compact in some specimens; generally with posterior laminar expansion moderately developed; poorly- or relatively well developed in some specimens; inner laminar expansion ranging from moderately- to well developed; posteroventral margin close but not directly contacting posterodorsal ridge of hyomandibula; contacting in some specimens; dorsal tip contacting only sphenotic; external surface partially covered by thick layer of skin; entirely covered by thick layer of skin in some specimens (Fig. 11). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong, generally exposed; entirely or almost entirely covered by thick layer of skin in some specimens; relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thick layer of skin; covered by thin layer of skin, exposed, in some specimens; exposed areas generally bearing small odontodes. Interopercle with posterior portion exposed; entirely covered by thick layer of skin in some specimens; somewhat triangular, anterior projection moderately developed; well developed in some specimens. Preopercle relatively slender, elongated, minute odontodes sparse on external surface; entirely or almost entirely covered by thick layer of skin in some specimens. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion; conspicuously well developed, about triple size of cartilaginous portion in some specimens. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; process strongly reduced in some specimens; ceratobranchial 3 generally with continuous postero-lateral margin; variably notched; ceratobranchial 5 toothed on posterodorsal surface, 25 to 34 (22) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens. Upper tooth plate oval; 29 to 42 (22) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel; slightly shorter; pore opening closer to supraorbital main canal in some specimens. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore generally fused with first pore. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two or three pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third or fourth dorsolateral body plate. Dorsal-fin rays II,7 (1), II,8* (23), II,9 (1), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly developed in length; strongly reduced in some specimens; generally, entirely covered by thick layer of skin; posterior portion exposed and with minute odontodes in some specimens (Fig. 12); spinelet extremely short or short; partially exposed or entirely covered by thick layer of skin; spine poorly developed, adpressed distal tip reaching to middle portion of dorsal-fin base; or moderately developed, adpressed distal tip slightly surpassing middle portion of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,8 (1), I,9* (24); posterior margin of pectoral spine with eight to 24 poorly- or moderately-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 13). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, generally externally visible; or covered by thick layer of skin, not externally visible. Pelvic fin oblong, located just below fourth

or fifth ventrolateral body plate, and at vertical through third dorsal-fin branched ray. Pelvic-fin rays i,5* (25). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by nine to 11 dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 13th, 14th or 15th ventrolateral body plates, and at vertical through region of preadipose platelets; anterior to region of preadipose platelets in some specimens. Anal-fin rays ii,6* (25). Caudal-fin rays i,12,i* (24), i,13,i (1), generally five or six dorsal and/or ventral procurent rays; bilobed, dorsal lobe slightly larger than ventral lobe.

Two to four laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third and fourth lateral-line canals, if present, encased in third and fourth dorsolateral body plates, respectively. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 26* (4), 27 (10), 28 (10), 29 (1); ventrolateral body plates 23* (2), 24 (6), 25 (17); dorsolateral body plates along dorsal-fin base 5 (2), 6* (16), 7 (7); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (2), 8* (14), 9 (8), 10 (1); preadipose platelets 4 (3), 5* (12), 6 (7), 7 (3), 8 (1); 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. Anterior margin of orbit, above region of junction of frontal with lateral ethmoid, with small platelets; platelets absent in some specimens. Ventrolateral portion of snout, region of nasal capsule and dorsal portion of snout, above mesethmoid, with small platelets in some specimens (Fig. 11b). Region between nuchal plate and posterior process of parieto-supraoccipital with relatively large platelets in some specimens. Ventral surface of trunk covered by small platelets, generally more abundant and/or concentrated on anterior half of trunk; absence of platelets in some specimens.

Vertebral count 24 (1), 25 (11), 26 (8), 27 (2); ribs 6 (2), 7 (18), 8 (2), first pair conspicuously large; parapophysis of complex vertebra poorly or moderately developed.

Coloration in alcohol. Color pattern highly variable. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; forming dark brown or black rounded, striated or irregular spots in some specimens; with dark brown or black diffuse stripe from anteroventral portion of eye to upper lip lateral area in some specimens; ventrolateral portion of snout with dark brown or black

chromatophores in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens; region of isthmus around lower lip with dark brown or black chromatophores in some specimens. Dorsal series of four to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second, if present, on middle portion of dorsal-fin base, third on posterior portion of dorsal-fin base, fourth on adipose-fin base, fifth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk and region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of three to six medium- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; blotches fused with each other, forming longitudinal stripe in single specimen (DZSJRP 12585, 29.9 mm SL). Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, between dorsal and adipose fins, adipose-fin base, between adipose and base of caudal peduncle and base of caudal peduncle with more concentrated chromatophores, forming conspicuous blotches in some specimens; fused to flank midline blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores; forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; fused to flank midline blotches in some specimens; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming longitudinal or oblique bars in some specimens; conspicuous concentration of dark brown or black chromatophores on some areas of membranes, forming larger dark brown or black patches in some specimens; almost entirely solid black or covered by dark brown or black

chromatophores in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; covered by dark brown or black spots in some specimens; spots generally diffuse and more evident on first branched rays; or entirely hyaline; region of body around dorsal portion of pectoral-fin origin generally with concentration of dark brown or black chromatophores. Pelvic fin generally hyaline or with sparse dark brown or black chromatophores on its dorsal surface; with conspicuous concentration of dark brown or black chromatophores on its proximal two thirds or forming up to two oblong dark brown or black patches in some specimens; region of body around dorsal portion of pelvic-fin origin with concentration of dark brown or black chromatophores in some specimens. Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one to three dark brown or black blotches in some specimens; entirely or almost entirely covered by dark brown or black chromatophores in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender to thick bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 14).

Geographical distribution. *Aspidoras albater* is known from the upper portions of the Tocantins and Paraná river basins in Goiás State, upper rio Araguaia basin in Goiás and Mato Grosso states, and upper rio Paraguay basin in Mato Grosso State (Fig. 9a).

Remarks. According to Nijssen & Isbrücker (1976), *A. albater* can be recognized by the presence of four large oblique black blotches on body. As aforementioned (see Color in alcohol), the dark brown or black blotches on dorsal and/or ventral portions of flanks can be

fused to flank midline blotches, resulting in a somewhat oblique and large blotch. However, from the five type specimens examined herein, only in the holotype and a single paratype this feature can be found in all blotches (Figs. 10, 15a). The other three paratypes also present rounded blotches, with midline blotch not fused to any dorsal or ventral blotches, or even transversally elongated blotches (Fig. 15b–d). Additionally, several non-type specimens do not present any flank midline blotch obliquely fused to dorsal and/or ventral blotches. Therefore, since this feature is highly variable and may be present in other *Aspidoras* species, such as *A. depinnai* and *A. kiriri*, it should not be considered as diagnostic for *A. albater*.

Aspidoras eurycephalus (Fig. 16) was described from the rio Maranhão basin, also part of the upper rio Tocantins drainage. Comparing only the holotypes, *A. albater* can be distinguished from *A. eurycephalus* by presenting the following combination of features: (I) absence of contact between counterparts of dorsolateral body plates on predorsal region of body (*vs.* presence); (II) posterior process of the parieto-supraoccipital poorly developed (*vs.* strongly reduced); (III) pectoral spine poorly developed but clearly larger (*vs.* poorly developed but clearly smaller); (IV) smaller interorbital width (*vs.* larger); and (V) ventral laminar expansion of infraorbital 1 moderately developed (*vs.* well developed). Despite the holotypes present these remarkable differences, most of the examined specimens from the upper rio Tocantins basin, including even some paratypes of *A. albater*, presents intermediate morphological pattern or a mix between *A. albater* and *A. eurycephalus* patterns. Three of the four examined paratypes of *A. albater* presents mixed general morphological pattern (Fig. 15a,c,d), and one of them is almost equal the holotype (Fig. 15b). Interestingly, the paratype of *A. albater* with the most similar color pattern to the holotype is the most similar in morphology to *A. eurycephalus* holotype.

Intermediate or mixed morphotypes between *A. albater* and *A. eurycephalus* holotypes were also found in the upper portions of the rivers Araguaia, Paraguay and Paraná basins. Lima & Britto (2001) described *A. taurus* (Fig. 17) based on the following diagnostic features: (I) infraorbitals and preopercle covered by thick skin and not visible externally; (II) nuchal plate reduced, covered by thick skin and not visible externally; and (III) absence of lateral line posterior to two small lateral line ossicles. Regarding feature (I), the examination of several specimens from the *A. taurus* type-series, including the holotype, and additional non-type specimens (LBP 1427), revealed that only the infraorbital 2 and preopercle can be entirely covered by thick layer of skin in some specimens, contrary to the infraorbital 1, that is at least partially externally visible in all examined specimens. In some *A. taurus* specimens, as well as in some specimens from the rivers Araguaia, Tocantins and Paraná basins, the ventral laminar

expansion of infraorbital 1 is almost reduced to the latero-sensory canal, resulting in a very small exposed area in those specimens, which is difficult to observe with naked eyes and may cause the wrong perception that the infraorbital 1 is not exposed. Despite it was possible to confirm the presence of the features (II) and (III) in *A. taurus*, they can also be observed in specimens from the rivers Araguaia, Tocantins and Paraná basins.

One of the most remarkable features of *A. taurus* is the relative extremely large size of some specimens, reaching more than 50 mm SL, though most specimens presents the expected size to the genus, which is generally inferior to 40 mm SL. However, considering general morphological pattern, even these unusually large specimens are notably similar to the holotype of *A. eurycephalus* and some paratypes of *A. albater*. Additionally, it is also possible to find relatively large-sized specimens in populations from the rivers Araguaia (LIRP 4472, up to 40.1 mm SL, Fig. 18; MZUSP 41409, up to 44.6 mm SL), Tocantins (MZUSP 114391, up to 40.0 mm SL) and Paraná (DZSJRP 9963, up to 41.6 mm SL) basins. Considering each examined feature (e.g. infraorbital 1, predorsal, pectoral spine, interorbital, and color patterns), the holotypes of *A. albater*, *A. eurycephalus* and *A. taurus* alternately represented two extreme forms of a morphological range, with one of them, as well as most additional examined specimens, falling in between the other two, and, since no conspicuous diagnostic features were observed, the most reasonable decision is to place *A. eurycephalus* and *A. taurus* in the synonymy of *A. albater*.

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976), the following material was examined. All from Brazil. DZSJRP 9963, 8, 24.3–41.6 mm SL, Distrito Federal, córrego Vicente Pires, rio Paraná basin. DZSJRP 12585, 20 of 33, 14.5–29.9 mm SL, Mato Grosso State, stream tributary to the rio Itiquira, rio Paraguay basin. DZSJRP 19858, 23, 21.9–37.9 mm SL, Mato Grosso State, córrego Fundo II, rio Araguaia basin. INPA 39901, 10 of 91, 17.4–19.3 mm SL, Goiás State, rio Areia, rio Tocantins basin. LBP 1427, 29, 17.2–39.5 mm SL, 2 CS, 23.8–36.7 mm SL, Mato Grosso State, rio Itiquira, rio Paraguay basin. LBP 15302, 2, 28.3–33.4 mm SL, Goiás State, rio da Lapa, rio Tocantins basin. LBP 15657, 1, 22.2 mm SL, Mato Grosso State, tributary to the rio das Mortes, rio Araguaia basin. LBP 19277, 8, 24.8–35.4 mm SL, Goiás State, córrego Kavanca, rio Tocantins basin. LBP 19312, 1, 27.6 mm SL, Goiás State, unnamed stream, rio Tocantins basin. LESCI 334, 1, 32.7 mm SL, Goiás State, Angélica Cave, rio Tocantins basin. LIRP 4447, 5, 14.9–25.8 mm SL, 1 CS, 29.4 mm SL, Mato Grosso State, córrego Rico, rio Araguaia basin. LIRP 4472, 85 of 162, 20.4–40.1 mm SL, 3 CS of 162, 29.4–31.9 mm SL, Mato Grosso State, córrego Carneiro, rio Araguaia basin. LISDEBE

6606, 24.7 mm SL, Goiás State, unnamed stream, rio Tocantins basin. MCP 45556, 6, 18.7–24.2 mm SL, Goiás State, córrego Galheiros, rio Tocantins basin. MNRJ 11716, 66 of 69, 16.0–29.6 mm SL, 3 CS of 69, 26.7–29.9 mm SL, Goiás State, córrego Pontilhão, rio Tocantins basin. MNRJ 12564, 6, 24.3–34.7 mm SL, Goiás State, ribeirão do Padre, rio Tocantins basin. MNRJ 12571, 10 of 26, 22.2–33.4 mm SL, 1 CS of 26, 35.3 mm SL, Goiás State, stream tributary to the rio Tocantins, rio Tocantins basin. MNRJ 12581, 39 of 44, 14.6–29.7 mm SL, 5 CS of 44, 22.5–31.1 mm SL, stream tributary to the rio Tocantins, rio Tocantins basin. MNRJ 12725, 3, 25.0–27.3 mm SL, Goiás State, córrego Batéias, rio Tocantins basin. MNRJ 12766, 1, 23.4 mm SL, Goiás State, rio da Mula, rio Tocantins basin. MNRJ 12775, 3, 14.5–25.5 mm SL, Goiás State, stream tributary to the rio Tocantins, rio Tocantins basin. MNRJ 12779, 8, 27.4–28.8 mm SL, 1 CS, 31.3 mm SL, Goiás State, córrego Bateinha, rio Tocantins basin. MNRJ 13044, 2, 18.5–32.9 mm SL, Goiás State, córrego Quineira or Mangueira, rio Tocantins basin. MNRJ 13045, 34 of 36, 16.6–25.6 mm SL, 2 CS of 36, 24.0–29.3 mm SL, Goiás State, córrego Batéias, rio Tocantins basin. MNRJ 13050, 25 of 28, 19.0–29.9 mm SL, 3 CS of 28, 17.6–32.5 mm SL, Goiás State, córrego Pontilhão, rio Tocantins basin. MNRJ 13051, 1, 20.9 mm SL, Goiás State, córrego Pirapitinga, rio Tocantins basin. MNRJ 13052, 5, 27.7–32.2 mm SL, 1 CS, 36.5 mm SL, Goiás State, córrego Grota Seca, rio Tocantins basin. MNRJ 13053, 3, 28.1–37.4 mm SL, Goiás State, tributary to the córrego Lageado, rio Tocantins basin. MNRJ 13054, 20, 14.0–26.6 mm SL, Goiás State, córrego Batéias, rio Tocantins basin. MNRJ 13055, 4, 20.2–36.0 mm SL, 1 CS, 27.2 mm SL, Goiás State, Matula Stream, rio Tocantins basin. MNRJ 13056, 9, 19.3–29.8 mm SL, Goiás State, stream tributary to the córrego Lageado, rio Tocantins basin. MNRJ 13080, 8, 10.4–34.7 mm SL, 1 CS, 30.9 mm SL, Goiás State, córrego São Bento, rio Tocantins basin. MNRJ 13081, 2, 28.4–33.0 mm SL, Goiás State, stream tributary to the córrego São Bento, rio Tocantins basin. MNRJ 13082, 6, 15.2–29.5 mm SL, Goiás State, córrego Quineira or Mangueira, rio Tocantins basin. MNRJ 19984, 1, 35.6 mm SL, Distrito Federal, stream tributary to the lago Paranoá, rio Paraná basin. MNRJ 20258, 3, 14.3–36.8 mm SL, Goiás State, córrego Coqueiro, rio Paraná basin. MNRJ 20332, 2, 26.9–29.7 mm SL, Goiás State, córrego Águas Emendadas, rio Paraná basin. MNRJ 21075, 17, 14.7–28.2 mm SL, 2 CS, 25.0–25.9 mm SL, Mato Grosso State, stream tributary to the rio das Garças, rio Araguaia basin. MNRJ 28880, 8, 22.7–32.9 mm SL, Goiás State, córrego Água Boa, rio Tocantins basin. MNRJ 28881, 3, 25.7–26.7 mm SL, Goiás State, córrego Batéia, rio Tocantins basin. MNRJ 36166, 9, 26.5–33.4 mm SL, Goiás State, córrego Água Boa, rio Tocantins basin. MZUSP 28599, 29, 13.8–36.4 mm SL, Mato Grosso State, rio Noidore, rio Araguaia basin. MZUSP 40624, 4, 23.7–30.1 mm SL, Goiás State, rio Angélica, rio Tocantins basin. MZUSP 40656, 2, 19.4–24.8 mm SL, Goiás

State, rio Preto, rio Tocantins basin. MZUSP 40683, 1, 28.8 mm SL, Goiás State, rio Bezerra, rio Tocantins basin. MZUSP 40793, 45 of 46, 14.8–33.5 mm SL, 1 CS of 46, 29.4 mm SL, Goiás State, stream tributary to the rio das Almas, rio Tocantins basin. MZUSP 40799, 7, 23.3–28.5 mm SL, swamp tributary to the córrego Ave Maria, rio Tocantins basin. MZUSP 40806, 3, 21.8–27.2 mm SL, Goiás State, stream tributary to the córrego Ave Maria, rio Tocantins basin. MZUSP 40811, 74, 21.2–32.9 mm SL, Goiás State, stream tributary to the córrego Ave Maria, rio Tocantins basin. MZUSP 40815, 2, 21.3–28.3 mm SL, Goiás State, stream tributary to the rio das Pedras, rio Tocantins basin. MZUSP 40886, 5, 21.6–35.9 mm SL, Goiás State, córrego Poço Danta, rio Tocantins basin. MZUSP 41409, 131, 12.1–44.6 mm SL, Goiás State, grotto on the road to Couto de Magalhães Falls, rio Araguaia basin. MZUSP 41424, 7, 14.5–33.9 mm SL, Goiás State, córrego do Jacaré, rio Araguaia basin. MZUSP 41434, 8, 9.8–21.1 mm SL, Goiás State, ribeirão Capivara, rio Paraná basin. MZUSP 49853, 5, 17.0–35.4 mm SL, Goiás State, stream in the Serra da Mesa, rio Tocantins basin. MZUSP 50157, 35, 11.3–31.3 mm SL, Goiás State, Serra da Mesa Lake, rio Tocantins basin. MZUSP 54468, 100, 21.1–35.4 mm SL, Goiás State, rio Bagagem, rio Tocantins basin. MZUSP 55221, 56, 14.7–31.8 mm SL, Goiás State, rio da Lapa, rio Tocantins basin. MZUSP 55238, 6, 16.8–23.4 mm SL, Goiás State, rio da Lapa, rio Tocantins basin. MZUSP 55244, 1, 25.2 mm SL, Goiás State, rio Angélica, rio Tocantins basin. MZUSP 55250, 1, 26.0 mm SL, Goiás State, rio Angélica, rio Tocantins basin. MZUSP 55967, 9, 18.7–28.0 mm SL, Goiás State, rio da Lapa sinkhole, rio Tocantins basin. MZUSP 55983, 2, 26.6–27.1 mm SL, Goiás State, córrego Quilombo, rio Tocantins basin. MZUSP 55985, 1, 25.3 mm SL, Goiás State, lapa Angélica, rio Tocantins basin. MZUSP 57407, 16, 15.9–23.1 mm SL, stream tributary to the rio São Domingos, rio Tocantins basin. MZUSP 81661, 1, 33.0 mm SL, Goiás State, rio Angélica, rio Tocantins basin. MZUSP 81662, 1, 27.1 mm SL, Goiás State, lapa Angélica, rio Tocantins basin. MZUSP 85771, 5, 18.2–27.9 mm SL, Goiás State, rio da Lapa, rio Tocantins basin. MZUSP 88144, 2, 23.0–34.4 mm SL, Mato Grosso State, tributary to the rio das Garças, rio Araguaia basin. MZUSP 89424, 2, 25.2–27.3 mm SL, Goiás State, ribeirão d’Anta, rio Araguaia basin. MZUSP 97858, 10 of 23, 13.3–27.3 mm SL, Mato Grosso State, unnamed stream, rio Araguaia basin. MZUSP 114074, 3, 15.6–23.2 mm SL, Goiás State, ribeirão dos Bois, rio Tocantins basin. MZUSP 114080, 2, 25.9–30.2 mm SL, Goiás State, stream tributary to the rio dos Bois, rio Tocantins basin. MZUSP 114082, 12, 20.1–32.7 mm SL, Goiás State, stream tributary to the rio dos Bois, rio Tocantins basin. MZUSP 114089, 4, 16.2–29.5 mm SL, Goiás State, rio São João, rio Tocantins basin. MZUSP 114128, 5, 19.6–26.2 mm SL, Tocantins State, córrego Bezerra, rio Tocantins basin. MZUSP 114300, 15, 18.0–30.6 mm SL, Goiás State, stream tributary to the rio Galheiros, rio Tocantins

basin. MZUSP 114357, 7, 22.2–29.4 mm SL, Goiás State, rio Muquém, rio Tocantins basin. MZUSP 114372, 4, 22.4–30.8 mm SL, Goiás State, stream tributary to the rio Claro, rio Tocantins basin. MZUSP 114391, 64, 13.2–40.0 mm SL, Goiás State, tributary to the rio das Almas, rio Tocantins basin. MZUSP 114398, 18, 16.2–28.7 mm SL, Goiás State, stream tributary to the rio Paranã, rio Tocantins basin. MZUSP 114401, 20 of 21, 20.3–35.9 mm SL, 1 CS of 21, 30.1 mm SL, Goiás State, stream tributary to the rio Paranã, rio Tocantins basin. NUP 1098, 5, 20.2–39.7 mm SL, 1 CS, 33.8 mm SL, Goiás State, Corumbá Reservoir, rio Paraná basin. NUP 1286, 2, 19.7–27.9 mm SL, Goiás State, ribeirão Cachoeira, rio Paraná basin. UFRJ 6434, 13, 16.8–28.5 mm SL, Goiás State, stream tributary to the rio Caiapó, rio Araguaia basin. UNT 10233, 5, 14.6–21.5 mm SL, Goiás State, rio do Peixe, rio Tocantins basin. UNT 14686, 14, 12.6–33.2 mm SL, Goiás State, córrego Grotão or Maria Rita, rio Tocantins basin. UFBA 8077, 6 of 11, 19.4–30.1 mm SL, Goiás State, stream tributary to the rio das Almas, rio Tocantins basin. UNT 10225, 6, 8.8–24.4 mm SL, Goiás, rio Buritizal, rio Tocantins basin.

***Aspidoras belenos* Britto, 1998**

(Fig. 19)

Aspidoras belenos Britto, 1998: 361 (original description; type-locality: creek at Primavera do Leste – Paranatinga road, 82 kilometers north from Primavera do Leste, Mato Grosso State, Brazil). –Britto, 2000: 1054 (listed as comparative material). –Lima & Britto, 2001: 1015 (listed as comparative material). –Britto, 2003: 144 (phylogeny). –Reis, 2003: 292 (listed). –Ferraris, 2007: 108 (listed). –Wosiacki *et al.*, 2014: 315 (listed as comparative material). –Leão *et al.*, 2015: 578 (morphological comparison). –Oliveira *et al.*, 2017: e160118[7] (listed as comparative material). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras belenos* can be distinguished from its congeners, with exception of *A. kiriri*, *A. raimundi* and *Aspidoras* sp., by having parapophysis of the complex vertebra well developed (vs. moderately developed in *A. depinnai*, *A. lakoi*, *A. maculosus*, *A. mephisto*, *A. poecilus*, *A. psammatides* and *A. velites*; poorly to moderately developed in *A. albater* and *A. fuscoguttatus*); it differs from *A. kiriri* by the absence of a large and intensely pigmented black blotch on dorsal fin (vs. presence); from *Aspidoras* sp. by having anterior portion of infraorbital 1 with extremely well-developed laminar expansion, reaching to or surpassing anterior margin of nasal capsule (vs. ranging from poorly developed, slightly surpassing posterior margin of

nasal capsule, to moderately developed, reaching to middle of nasal capsule); it can be distinguished from *A. raimundi* by having the following combination of features: absence of large and intensely pigmented dark brown or black blotch on dorsal fin (*vs.* generally present), and markings on ventrolateral body plates generally present and clearly more numerous, not considering the number of blotches in the series along flank midline (*vs.* markings, when present, clearly scarcer).

Description. Head compressed with convex dorsal profile; triangular or somewhat trapezoid in dorsal view. Snout moderately developed and pointed. Head profile convex from tip of snout to anterior nares; ascending slightly convex from this point to dorsal-fin origin; region of parieto-supraoccipital process slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or slightly smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate in size, not reaching to anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming one triangular or semicircular fleshy flap; forming structure similar to barbel in some specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip relatively well developed, equal to or slightly larger than 50% of bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, entirely covered by thick layer of skin; exposed in some specimens. Nasal slender, curved laterally, inner margin with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border generally contacting only frontal.

Frontal elongated, narrow, with width slightly smaller than half of entire length (see Fig. 3); anterior projection short, size smaller than nasal length. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process moderately developed, close but not directly contacting nuchal plate; directly in contact in some specimens. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion generally expanded posteriorly, slightly surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion from well to extremely well developed; anterior portion generally with extremely well-developed laminar expansion, reaching to or surpassing anterior margin of nasal capsule (Fig. 20); inner laminar expansion generally moderately developed (see Fig. 5); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion poorly developed; inner laminar expansion moderately developed; posteroventral margin contacting posterodorsal ridge of hyomandibula, dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 20). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle exposed; exposed areas generally bearing small odontodes. Interopercle covered by thick layer of skin on its anterior portion; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle more elongated dorso-ventrally, width equal to or slightly larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion moderately developed, about same size of cartilaginous portion. Five

ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 19 to 22 (2) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, lacking small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with round notch in some specimens. Upper tooth plate oval; 24 to 28 (2) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel. Nasal canal with three openings, first on posterior edge, second on posterolateral portion, generally fused with the first pore, and third on anterior edge. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and generally opening into two pores. Preoperculomandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to second or third dorsolateral body plate. Dorsal-fin rays II,7,i* (2), II,8 (1); posterior margin of dorsal-fin spine smooth. Nuchal plate moderately developed in length; almost entirely exposed; anterior tip covered by thick layer of skin (Fig. 21); spinelet short, partially exposed; spine relatively well developed, adpressed distal tip reaching to or slightly surpassing posterior origin of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,8* (3); posterior margin of pectoral spine with 14 to 23 poorly- or moderately-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine,

perpendicularly directed or directed towards tip of spine; bifid serrations generally present; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 22). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third ventrolateral body plate, and at vertical through second dorsal-fin branched ray. Pelvic-fin rays $i,5^*$ (3). Adipose fin somewhat triangular, separated from posterior origin of dorsal-fin base by seven or eight dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 12th or 13th ventrolateral body plates, and at vertical through adipose-fin spine origin or region of preadipose platelets. Anal-fin rays, $ii,5$ (1), $ii,5,i^*$ (2). Caudal-fin rays $i,12,i^*$ (3), generally four or five dorsal and/or ventral procurrent rays; bilobed; dorsal and ventral lobes with similar size; dorsal lobe slightly larger or smaller than ventral lobe in some specimens.

Three to five laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third, fourth, and fifth lateral-line canals, if present, encased in third, fourth, fifth dorsolateral body plates, respectively; sixth plate on left side of body with isolated pore in one paratype (UFRJ 1206, 21.4 mm SL). Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 23 (1), 25* (2); ventrolateral body plates 21 (1), 22* (2); dorsolateral body plates along dorsal-fin base 5* (3); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (1), 9* (2); preadipose platelets 2 (1), 3* (2); 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. Anterior margin of orbit, above junction of frontal and lateral ethmoid, with small platelets. Ventrolateral portion of snout with relatively large platelets in some specimens. Ventral surface of trunk with small irregular platelets.

Vertebral count 23 (2); ribs 5 (1), 6 (1), first pair conspicuously large; parapophysis of complex vertebra well developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout with dark brown or black chromatophores on its dorsal surface, generally forming dark brown or black rounded, irregular or striated and relatively large spots in some specimens; generally, with dark brown or black diffuse or

conspicuous stripe from anteroventral portion of eye to upper lip lateral area. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens. Dorsal series of four to six dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third, if present, between dorsal and adipose fins, fourth on adipose-fin base, fifth, if present, on middle portion of caudal peduncle, and sixth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorsolateral plates and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of four to five medium-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base and adipose-fin base with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming oblique bars in some specimens; membranes with dark brown or black chromatophores, generally more evident on region of first and second branched rays proximal portion; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface; chromatophores more evident on spine and first branched rays in some specimens; covered by dark brown or black spots in some specimens; spots generally diffuse and more evident on first branched rays. Pelvic fin generally with sparse dark brown or black chromatophores on its dorsal surface; almost

entirely hyaline in some specimens. Adipose-fin membrane with dark brown or black chromatophores, generally more concentrated on its posterior portion; spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; generally, forming one dark brown or black blotch. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to four transversal dark brown or black slender bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow iridescent coloration (Fig. 23).

Geographical distribution. *Aspidoras belenos* is known only from the Suspiro River basin, its type-locality, a tributary to the das Mortes River basin, in the Mato Grosso State (Fig. 9a).

Material examined. In addition to the material examined by Britto (1998: 361), the following material was examined: MZUSP 97703, 1, 22.3 mm SL, Mato Grosso State, stream tributary to the rio Suspiro, rio Araguaia basin.

***Aspidoras brunneus* Nijssen & Isbrücker, 1976**

(Fig. 24)

Aspidoras brunneus Nijssen & Isbrücker, 1976: 116 (original description; type-locality: Serra do Roncador, kilometer 125 of the road Chavantina-Casximba [sic, = Xavantina-Cachimbo], Mato Grosso State, Brazil). –Britto, 2000: 1054 (listed as comparative material). –Lima & Britto, 2001: 1015 (listed as comparative material). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Leão *et al.*, 2015: 578 (morphological comparison). –Oliveira *et al.*, 2017: e160118[7] (morphological comparison).

Diagnosis. *Aspidoras brunneus* can be distinguished from all of its congeners by having a thick, longitudinal conspicuous dark brown stripe along dorsal portion of flank present (*vs.* absence).

Remarks. *Aspidoras brunneus* was described based on six specimens collected in “Mato Grosso, Serra do Roncador, km 125 of the road Chavantina-Casximba” (see Nijssen &

Isbrücker, 1976: 116). The road mentioned by the authors must be the Xavantina-Cachimbo road, depicted by Lowe-McConnell (1991: 65, fig. 1), which seems to be, at least partially, equivalent to the current BR-158 road. The Serra do Roncador region is drained by the rivers Araguaia and Xingu basin (see Lowe-McConnell, 1991), and following both BR-158 and Xavantina-Cachimbo roads, it is possible to see tributaries from both basins crossing or close to them in several points. Therefore, even with the kilometer reference, it is not possible to undoubtedly state the basin in which *A. brunneus* was captured without a more accurate collecting data, though some studies explicitly pointed it as being from the Araguaia River basin (Wosiacki *et al.*, 2014: 314) or the Xingu River basin (Britto, 2000: 1048; Leão *et al.*, 2015: 583). Contrary to its unclear type locality, *A. brunneus* is one of the most peculiar species of the genus, being promptly diagnosed from all of its congeners by the presence of a thick, longitudinal conspicuous dark brown stripe along dorsal portion of flank (Fig. 24). However, even with the relatively large number of specimens from both Araguaia and Xingu basins in the Serra do Roncador region examined herein, no specimen with the unusual color pattern of *A. brunneus* was observed, and only *A. poecilus* was recorded from there. Since it was only possible to examine the holotype plus two paratypes through photographs, and no additional specimen was found, it was not possible to prepare the redescription for *A. brunneus*.

Material examined. Same as listed by Nijssen & Isbrücker (1976: 116).

***Aspidoras carvalhoi* Nijssen & Isbrücker, 1976**

(Fig. 25)

Aspidoras carvalhoi Nijssen & Isbrücker, 1976: 117 (original description; type-locality: Açude Canabrava, Guaramiranga, Ceará State, Brazil). –Britto, 2000: 1054 (listed as comparative material). –Lima & Britto, 2001: 1015 (listed as comparative material). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Leão *et al.*, 2015: 585 (listed as comparative material). –Oliveira *et al.*, 2017: e160118[3], e160118[7] (morphological comparison; listed as comparative material). –Tencatt & Bichuette, 2017: 8–9, 21 (morphological comparison; listed as comparative material).

Remarks. *Aspidoras carvalhoi* was described based on two specimens from the Guaramiranga region but, contrary to *A. rochai*, there is further available data regarding its type locality, the Canabrava (or Cana Brava) Weir, apparently drained by the Aracoiaba River system. According to Nijssen & Isbrücker (1976: 117), this species presents a very reduced pigmentation on body,

being described as “almost completely devoid of chromatophores; only a few dark brown isolated minute pigment spots on the lateral scutes, concentrated along or near the posterior edge of the scutes.”. Apparently, the authors considered that this was the undamaged color pattern of *A. carvalhoi*, using the presence of “Body without color pattern” as a diagnostic feature in their identification key (see p. 110). However, considering that these specimens were captured in 1947, nearly 30 years until they were examined by Nijssen & Isbruecker (1976), it seems more plausible to presume that the faded color pattern observed by them was due to bad preservation practices and/or precarious maintenance. Since the holotype of *A. carvalhoi* is severely damaged and the original description is little informative, allied to the fact that no additional specimen from the Aracoiaba River basin was found, it was not possible to clearly recognize *A. carvalhoi*. Therefore, we were not able to provide both new diagnosis and redescription or even include it in the identification key.

Material examined. Same as listed by Nijssen & Isbrücker (1976: 117).

***Aspidoras depinnai* Britto, 2000**

(Fig. 26)

Aspidoras depinnai Britto, 2000: 1049 (original description; type-locality: creek at Amaraji-Primavera road). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison). –Tencatt & Bichuette, 2017: 21 (listed as comparative material).

Diagnosis. *Aspidoras depinnai* can be distinguished from its congeners, with exception of *A. albater*, *A. fuscoguttatus*, *A. gabrieli*, *A. kiriri*, *A. poecilus* and *A. raimundi* by having dorsal fin with conspicuous concentration of dark brown or black chromatophores on its middle portion, forming large dark brown or black blotch (*vs.* absence); it can be distinguished from *A. albater* and *A. gabrieli* by having narrow frontal bone, with width slightly smaller than half of its entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length); from *A. fuscoguttatus* by lacking small spots on dorsal fin (*vs.* presenting); from *A. kiriri* by the presence of parapophysis of complex vertebra moderately developed (*vs.* well developed); from *A. poecilus* it differs by the presence of the following combination of features: dark brown or black stripe from anteroventral portion of eye to upper lip lateral, when present, less evident (*vs.* generally present and more evident), and flanks generally with fewer and/or less evident dark brown or black markings, not considering the number of blotches in the series along flank

midline (*vs.* markings generally more numerous and/or evident); and from *A. raimundi* it can be distinguished by the dorsal-fin color pattern (dark brown or black blotch on middle portion of dorsal fin less pigmented *vs.* dark brown or black blotch on middle portion of dorsal fin generally present and intensely pigmented; some specimens with obliquely fragmented blotch, forming two smaller blotches; region of blotch(es) with almost entirely hyaline membranes in some specimens, forming series of dark brown or black spots; presence of non-aligned dark brown or black small spots in some specimens), and by having inner laminar expansion of infraorbital 1 well developed (*vs.* moderately developed).

Description. Morphometric data of type specimens in Britto (2000), data of additional examined specimens presented in Table 3. Head compressed with convex dorsal profile; triangular or somewhat trapezoid in dorsal view. Snout moderately developed and rounded. Head profile convex from tip of snout to anterior nares; ascending slightly convex from this point to dorsal-fin origin; region of parieto-supraoccipital process slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or slightly smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming one or two triangular fleshy flaps. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip poorly developed, slightly smaller than 50% of bone length (see Britto, 2003: 123, character 1, state 1; fig. 1B); posterior portion wide, covered by thick layer of skin. Nasal slender, curved laterally, inner margin with moderately-developed laminar

expansion; outer margin with reduced laminar expansion; mesial border generally contacting only frontal.

Frontal elongated, narrow, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection short, size smaller than nasal length; anterior margin partially covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process poorly developed, not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion not reaching tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion from poorly to moderately developed; anterior portion with well-developed laminar expansion, slightly surpassing middle of nasal capsule (Fig. 27); inner laminar expansion well developed (see Fig. 5b); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion generally poorly developed; conspicuously reduced in some specimens; inner laminar expansion moderately developed; posteroventral margin close but not directly contacting posterodorsal ridge of hyomandibula, dorsal tip contacting only sphenotic; external surface partially covered by thick layer of skin (Fig. 27). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thin layer of skin; exposed areas generally bearing small odontodes. Interopercle covered by thick layer of skin on its anterior portion; or entirely covered by thick layer of skin; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 27 to 28 (2) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; process absent in some specimens; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion generally with rounded notch. Upper tooth plate oval; 30 to 34 (2) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel; slightly shorter; pore opening closer to supraorbital main canal in some specimens. Nasal canal with three openings, first on posterior edge, second on posterolateral portion, generally fused with the first pore, and third on anterior edge. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two or three pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,8 (15), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly to moderately developed in length; almost entirely exposed, with minute odontodes on exposed area; anterior tip covered by thick layer of skin (Fig. 28); spinelet extremely short to short, partially exposed; spine poorly developed, adpressed distal tip generally not reaching to middle portion of dorsal-fin base; or reaching to middle portion of dorsal-fin base; anterior margin with

small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,9 (13), I,10 (2); posterior margin of pectoral spine with nine to 22 moderately-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 29). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third or fourth ventrolateral body plate, and at vertical through third dorsal-fin branched ray. Pelvic-fin rays i,5 (15). Adipose fin somewhat triangular, separated from posterior origin of dorsal-fin base by generally eight dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 13th or 14th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin rays, ii,6 (11), ii,5,i (4). Caudal-fin rays i,12,i (15), generally five dorsal and/or ventral procurrent rays; bilobed; dorsal and ventral lobes with similar size.

Two or three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal, if present, encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 25 (4), 26 (7), 27 (3), 28 (1); ventrolateral body plates 22 (1), 23 (8), 24 (6); dorsolateral body plates along dorsal-fin base 6 (11), 7 (4); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (1), 8 (4). 9 (10); preadipose platelets 3 (8), 4 (6), 5 (1); 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. Anterior margin of orbit, above junction of frontal and lateral ethmoid, with small platelets. Ventral surface of trunk with small irregular platelets.

Vertebral count 22 (1), 24 (1); ribs 6 (2), first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; forming dark brown

or black rounded or irregular spots in some specimens; with dark brown or black diffuse stripe from anteroventral portion of eye to upper lip lateral area in some specimens; ventrolateral portion of snout with dark brown or black chromatophores in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens. Dorsal series of four dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, and fourth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of four to five medium- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of posterior portion of dorsal-fin base and adipose-fin base with more concentrated chromatophores, forming conspicuous blotches in some specimens; blotches fused to flank midline blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; fused to flank midline blotches in some specimens; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin lacking small spots; conspicuous concentration of dark brown or black chromatophores on its middle portion, forming large dark brown or black blotch; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; covered by dark brown or black spots in some specimens; spots generally diffuse and more evident on first branched rays. Pelvic fin

generally hyaline or with sparse dark brown or black chromatophores on its dorsal surface. Adipose-fin membrane with dark brown or black chromatophores, generally more concentrated on its posterior portion; spine generally with dark brown or black chromatophores. Anal fin with dark brown or black chromatophores on middle portion of its branched rays; or lacking chromatophores in this region; chromatophores concentrated on bases of last branched rays. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to four transversal dark brown or black slender to thick bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 30).

Geographical distribution. *Aspidoras depinnai* is known from the rio Ipojuca basin, its type-locality, and from the rio Ipanema basin, a tributary to the lower rio São Francisco basin, both in the Pernambuco State (Fig. 9b).

Remarks. Britto (2000) pointed out the presence of two interesting and apparently exclusive features for *A. depinnai*: (I) an irregular row of minute pores on lateral portion of snout (Britto, 2000: 1051, fig. 3), and (II) a small cartilage between the upper principal and procurrent caudal-fin rays (Britto, 2000: 1052, fig. 5). Despite both features could be observed in the examined *A. depinnai* specimens, they were also simultaneously found in other *Aspidoras* species, such as *A. albater*, *A. poecilus* and *A. psammatides*. As mentioned by Britto (2000: 1053), this small cartilage between the upper principal and procurrent caudal-fin rays seems to be the opisthural cartilage (see Monod, 1968; McDowall, 1999). Despite it was not observed in all specimens and with exception of *A. kiriri*, *A. lakoi* and *A. maculosus*, all examined species of *Aspidoras* presented this cartilage (Fig. 31). The author also stated that the presence of bifid serrations restricted to the distal portion of the pectoral spine posterior margin can distinguish *A. depinnai* from all of its congeners. However, it was possible to observe some degree of variation in the c&s specimen examined herein (UFPB 6124), showing the pattern mentioned by Britto (2000) only on its left spine, whereas the right spine presents bifid serrations also on its proximal portion.

Aspidoras depinnai was described only from the Ipojuca River basin, Pernambuco State. However, the analysis of material from the Ipanema River basin, lower portion of the São Francisco River drainage, revealed the presence of *A. depinnai*, which can be explained by the relatively short distance between these basins, since the main channel of the Ipanema River is about 10 km from the Ipojuca River main channel at the region of Arcoverde, where most non-type specimens examined herein were captured.

Material examined. In addition to the material examined by Britto (2000: 1049), the following material was analysed. All from Brazil, Pernambuco State. UFBA 3820, 1 of 2, 33.2 mm SL, small dam in the córrego do Meio, rio São Francisco basin. UFPB 4382, 1 of 5, 22.1 mm SL, unnamed stream, rio Ipojuca basin. UFPB 6194, 6 of 7, 21.8–35.5 mm SL, 1 CS of 7, 28.0 mm SL, córrego do Meio, rio São Francisco basin. UFPB 7231, 5 of 6, 21.1–26.0 mm SL, unnamed stream, rio São Francisco basin. UFPB 9949, 2 of 3, 20.3–21.7 mm SL, stream tributary to the rio Mimoso, rio São Francisco basin.

***Aspidoras fuscoguttatus* Nijssen & Isbrücker, 1976**

(Fig. 32)

Aspidoras fuscoguttatus Nijssen & Isbrücker, 1976: 118 (original description; type-locality: córrego Corguinho, Pernambuco State, Brazil). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison). –Leão *et al.*, 2015: 582 (morphological comparison). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras fuscoguttatus* can be distinguished from its congeners, with exception of *A. albater*, *A. belenos*, *A. depinnai*, *A. kiriri*, *A. maculosus*, *A. mephisto*, *A. poecilus*, *A. raimundi* and *Aspidoras* sp., by having inner laminar expansion of infraorbital 1 generally well developed; variably moderately developed (*vs.* extremely well developed in *A. gabrieli* and *A. lakoi*; poorly developed in *A. psammaticides* and *A. velites*); from *A. albater*, *A. mephisto* and *Aspidoras* sp. by presenting anterior laminar expansion of infraorbital 1 ranging from well developed, surpassing middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule (*vs.* ranging from strongly reduced, at same level as posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. albater*; ranging from strongly reduced, not reaching to posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. mephisto*; ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed,

reaching to middle of nasal capsule in *Aspidoras* sp.); from *A. belenos* and *A. kiriri* plus *Aspidoras* sp. by having parapophysis of the complex vertebra generally moderately developed; variably poorly developed (*vs.* well developed); from *A. depinnai* by having small spots on dorsal fin (*vs.* lacking); from *A. maculosus* by the following combination of features: absence of relatively large, well-defined dark brown or black blotches on top of the head (*vs.* presence), inner laminar expansion of infraorbital 1 generally well developed (*vs.* moderately developed), and frontal bone generally relatively wide, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length); from *A. poecilus* it differs by having the following combination of features: inner laminar expansion of infraorbital 1 generally well developed (*vs.* generally moderately developed), flanks with more dark brown or black markings, not considering the number of blotches in the series along flank midline (*vs.* less markings), frontal bone generally relatively wide, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length), and generally less evident dark brown or black stripe from anteroventral portion of eye to upper lip lateral area (*vs.* generally more evident); it can be distinguished from *A. raimundi* by having the following combination of features: inner laminar expansion of infraorbital 1 generally well developed (*vs.* moderately developed), dorsal fin with small spots (*vs.* generally lacking small spots), and markings on ventrolateral body plates generally more numerous and evident, not considering the number of blotches in the series along flank midline (*vs.* markings on ventrolateral body plates, when present, generally less numerous and less evident, not considering the number of blotches in the series along flank midline)

Description. Morphometric data presented in Table 4. Head compressed with convex dorsal profile; triangular or somewhat trapezoid in dorsal view. Snout moderately developed and slightly pointed; or rounded. Head profile convex from tip of snout to anterior nares; ascending slightly convex from this point to dorsal-fin origin; region of parieto-supraoccipital process, frontals and/or mesethmoid slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight or slightly concave from this point to anal-fin origin; concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to, slightly larger or smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, small semicircular or triangular fleshy flap; with two triangular fleshy flaps in some specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip poorly developed, slightly smaller than 50% of bone length (see Britto, 2003: 123, character 1, state 1; fig. 1B); or relatively well developed, equal to 50% of bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, entirely or almost entirely covered by thick layer of skin. Nasal slender, curved laterally, inner margin with moderately- to well-developed laminar expansion; outer margin with reduced or moderately-developed laminar expansion; mesial border contacting only frontal; or contacting frontal and mesethmoid.

Frontal elongated, generally relatively wide, with width equal to or slightly larger than half of entire length (see Fig. 3b); narrow in some specimens, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection ranging from short, with size smaller than nasal length, to moderate, with size equal to nasal length; anterior margin partially or entirely covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process strongly reduced to poorly developed, not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; expanded posteriorly in some specimens, slightly surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally ranging from well developed to extremely well developed; poorly- or moderately-developed expansion in some specimens; anterior portion with laminar expansion ranging from well developed, surpassing middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule (Fig. 33); inner laminar expansion generally well developed (see Fig. 5b); single specimen with moderately-developed expansion (NUP 11397, 30 mm SL) (see Fig. 5c); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion generally moderately developed; relatively well developed in some specimens; inner laminar expansion moderately developed; posteroventral margin directly contacting posterodorsal ridge of hyomandibula, dorsal tip contacting only sphenotic; external surface partially covered by thick layer of skin (Fig. 33). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, relatively slender; entirely covered by thick layer of skin in some specimens; dorsal ridge of hyomandibula between compound pterotic and opercle generally exposed; entirely covered by thin or thick layer of skin in some specimens; exposed areas generally bearing small odontodes. Interopercle covered by thick layer of skin on its anterior portion; or entirely covered by thick layer of skin; somewhat triangular, anterior projection ranging from poorly- to well-developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; entire surface or some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion; extremely well developed in some specimens, about triple size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 25 to 30 (8) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with

notches in some specimens. Upper tooth plate oval; 28 to 44 (8) teeth generally aligned in two rows on postero-ventral surface; aligned in three rows in specimen MZUSP 62269.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel. Nasal canal with three openings, first on posterior edge, second on posterolateral portion, generally fused with the first pore, and third on anterior edge. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two or three pores. Preoperculomandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 generally opening at posterodorsal ridge of hyomandibula.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,8* (21), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly to moderately developed in length; posterior portion exposed, with minute odontodes; anterior tip covered by thick layer of skin (Fig. 34); nuchal plate entirely covered by thick layer of skin in specimen MZUSP 62269 (CS, 26.0 mm SL); spinelet extremely short or short; partially exposed; spine generally moderately developed, adpressed distal tip surpassing middle portion of dorsal-fin base; or poorly developed, adpressed distal tip reaching to middle portion of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,8* (29), I,9 (2); posterior margin of pectoral spine with 14 to 27 moderately- to well-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 35). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below

third or fourth ventrolateral body plate, and at vertical through third dorsal-fin branched ray. Pelvic-fin rays i,5* (21). Adipose fin somewhat triangular, separated from posterior origin of dorsal-fin base by eight or nine dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 13th or 14th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin rays, ii,5 (1), ii,6* (20). Caudal-fin rays i,11,i (2), i,12,i* (19), generally five or six dorsal and/or ventral procurrent rays; bilobed; dorsal lobe generally slightly larger than ventral lobe; or lobes with similar size.

Two or three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal, if present, encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 25 (1), 26 (2), 27* (15), 28 (3); ventrolateral body plates 23 (1), 24* (13), 25 (7); dorsolateral body plates along dorsal-fin base 6 (16), 7* (5); dorsolateral body plates between adipose-fin spine and caudal-fin base 6 (1), 7 (1), 8 (14), 9* (4), 10 (1); preadipose platelets 3* (1), 4 (5), 5 (10), 6 (5); single specimen (MZUSP 27298, 34.3 mm SL) with seven preadipose platelets; 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. Anterior margin of orbit, above junction of frontal and lateral ethmoid, and dorsal and lateral portions of snout with small platelets in some specimens. Region between nuchal plate and posterior process of parieto-supraoccipital generally with small- to medium-sized platelets (Fig. 3); Ventral surface of trunk generally densely covered by small irregular platelets.

Vertebral count 23 (1), 24 (3), 25 (5); ribs 6 (4), 7 (5), first pair conspicuously large; parapophysis of complex vertebra generally moderately developed; poorly developed in some specimens.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; generally forming dark brown or black rounded, striated or irregular spots; with dark brown or black diffuse stripe from anteroventral portion of eye to upper lip lateral area in some specimens; ventrolateral portion of snout with dark brown or black chromatophores. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel

with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens. Dorsal series of three to four dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, and fourth, if present, on caudal-fin base; blotches diffuse or absent in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of body on region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of four to six medium- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; fused to each other in some specimens. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of posterior portion of dorsal-fin base and adipose-fin base with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores; forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming longitudinal or oblique bars in some specimens; conspicuous concentration of dark brown or black chromatophores on some areas of membranes, forming larger dark brown or black patches in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; generally forming dark brown or black spots; spots more evident on first branched rays; diffuse spots in some specimens; or entirely hyaline; region of body around dorsal portion of pectoral-fin origin generally with concentration of dark brown or black chromatophores in some specimens. Pelvic fin generally hyaline or with sparse dark brown or black chromatophores on its dorsal surface; forming up to two oblong dark brown or black

patches in some specimens; region of body around dorsal portion of pelvic-fin origin with concentration of dark brown or black chromatophores in some specimens. Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one or two dark brown or black blotches in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 36).

Geographical distribution. *Aspidoras fuscoguttatus* is known from the upper Paraná River basin in Goiás, Mato Grosso do Sul, Minas Gerais and São Paulo states (Fig. 9a).

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976: 118) the following material was analysed. All from Brazil, upper rio Paraná basin. DZSJRP 1359, 20 of 29, 23.4–30.8 mm SL, São Paulo State, córrego do Cedro. DZSJRP 4414, 15 of 23, 14.7–30.2 mm SL, São Paulo State, stream tributary to the córrego do Cedro. DZSJRP 4422, 48, 11.7–33.4 mm SL, São Paulo State, stream tributary to the córrego do Cedro. DZSJRP 4877, 17, 20.0–36.6 mm SL, São Paulo Stream, córrego da Helena. 20.9–34.7 mm SL, São Paulo State, córrego Feio. DZSJRP 4909, 30 of 52, 18.1–31.3 mm SL, São Paulo State, stream tributary to the córrego Veadão. DZSJRP 4957, 10 of 17, 22.8–35.1 mm SL, São Paulo State, córrego do Cajueiro. DZSJRP 5978, 10 of 23, 15.7–23.9 mm SL, São Paulo State, unnamed stream tributary to the ribeirão da Prata. DZSJRP 5897, 7, 16.5–28.7 mm SL, São Paulo State, unnamed stream tributary to the rio São José dos Dourados. DZSJRP 5984, 17, 16.9–27.2 mm SL, São Paulo State, unnamed stream tributary to the rio São José dos Dourados. DZSJRP 6056, 20 of 35, 17.6–26.4 mm SL, São Paulo State, stream tributary to the ribeirão Buritis. DZSJRP 6156, 4, 17.5–23.2 mm SL, São Paulo State, stream tributary to the ribeirão Três Barras. DZSJRP 6187, 29 of 44, 16.6–29.4 mm SL, 1 CS of 44, 29.9 mm SL, São Paulo State, unnamed

stream tributary to the rio São José dos Dourados. DZSJRP 7270, 4, 16.2–29.4 mm SL, São Paulo State, unnamed stream tributary to the ribeirão Barreiro. DZSJRP 7277, 15 of 25, 17.9–30.7 mm SL, São Paulo State, unnamed stream tributary to the córrego Três Lagos. DZSJRP 9622, 7, 20.5–29.1 mm SL, São Paulo State, córrego Açoita Cavallo. DZSJRP 9702, 20 of 32, 15.9–32.6 mm SL, São Paulo State, córrego Invernada. DZSJRP 9746, 10 of 19, 18.1–39.1 mm SL, São Paulo State, córrego do Gregório. DZSJRP 9822, 23, 14.6–28.0 mm SL, São Paulo State, córrego do Cerne. DZSJRP 9852, 11, 16.9–25.0 mm SL, São Paulo State, unnamed stream tributary to the ribeirão Onça. DZSJRP 9882, 9, 16.4–30.4 mm SL, São Paulo State, unnamed tributary to the rio Turvo. DZSJRP 9898, 6 of 7, 23.4–29.9 mm SL, 1 CS of 7, 30.8 mm SL, São Paulo State, córrego do Barro Preto. DZSJRP 10944, 9, 19.7–26.9 mm SL, São Paulo State, stream tributary to the rio Tietê. DZSJRP 11090, 29 of 46, 11.7–27.6 mm SL, 1 CS of 46, 27.2 mm SL, São Paulo State, córrego Sucuri. DZSJRP 14125, 2, 22.4–23.6 mm SL, São Paulo State, tributary to the ribeirão Borboleta. DZSJRP 14959, 10 of 11, 25.3–33.8 mm SL, 1 CS of 11, 34.2 mm SL, São Paulo State, stream tributary to the rio Tietê. DZSJRP 18665, 4, 19.9–22.0 mm SL, São Paulo State, Volta Grande Reservoir. LBP 19447, 1 of 4, 28.2 mm SL, São Paulo State, unnamed stream tributary to the rio Grande. LIRP 8208, 1, 26.4 mm SL, São Paulo State, córrego dos Buritis. LIRP 8214, 11, 14.9–25.1 mm SL, São Paulo State, córrego Olhos d'água. LISDEBE 2560, 7, 13.5–29.5 mm SL, São Paulo State, stream tributary to córrego da Onça. LISDEBE 2901, 1, 18.1 mm SL, São Paulo State, Virgolino Power Plant. LISDEBE 2917, 8, 18.4–24.2 mm SL, São Paulo State, Virgolino Power Plant. LISDEBE 5489, 1, 15.5 mm SL, Mato Grosso do Sul State, Jupia Reservoir. LISDEBE 5561, 19 of 20, 19.6–28.9 mm SL, 1 CS, 30.4 mm SL, São Paulo State, córrego do Taquaral. LISDEBE 5569, 1, 26.0 mm SL, São Paulo State, ribeirão Tabarana. MNRJ 27298, 3, 25.6–34.3 mm SL, São Paulo State, uncertain locality. MNRJ 29812, 1, 18.9 mm SL, São Paulo State, córrego da Inácia. MNRJ 46493, 10, 20.5–31.9 mm SL, Minas Gerais State, córrego Capão Rico. MNRJ 48933, 4, 20.2–22.4 mm SL, Minas Gerais State, swampy area tributary to the rio Paranaíba. MZUSP 23138, 7, 22.4–29.0 mm SL, São Paulo State, córrego do Pernilongo. MZUSP 24516, 1, 30.5 mm SL, São Paulo State, São José do Rio Preto. MZUSP 35833, 30 of 34, 13.6–30.2 mm SL, São Paulo State, córrego São José. MZUSP 47763, 4, 20.7–24.0 mm SL, Goiás State, ribeirão João Leite and tributaries. MZUSP 62269, 46 of 47, 16.7–33.2 mm SL, 1 CS, 25.5 mm SL, Minas Gerais State, ribeirão Boa Vista. MZUSP 73237, 1, 23.1 mm SL, Minas Gerais State, stream tributary to the rio Piedade. MZUSP 85795, 15, 21.4–29.7 mm SL, São Paulo State, stream tributary to the rio Pardo. MZUSP 88357, 1, 25.3 mm SL, Mato Grosso do Sul State, stream tributary to the rio Paraná, crossing the road Três Lagoas-Selviria. MZUSP 92041, 2,

28.2–40.4 mm SL, São Paulo State, córrego Tamburi. MZUSP 101002, 1, 23.4 mm SL, São Paulo State, stream tributary to the rio Preto. NUP 9744, 7, 25.5–30.9 mm SL, Minas Gerais State, córrego Candinho. NUP 11397, 2 CS, 28.9–30.0 mm SL, Goiás State, rio dos Bois. NUP 12677, 25, 20.1–38.3 mm SL, 2 CS, 36.1–36.8 mm SL, Goiás State, rio Corumbá. NUP 19124, 5, 25.1–27.9 mm SL, Minas Gerais State, córrego do Jaó. NUP 19127, 5, 15.3–25.0 mm SL, Minas Gerais State, córrego Frutal. NUP 19133, 1, 30.9 mm SL, Minas Gerais State, córrego Frutal. NUP 19137, 2, 23.2–24.1 mm SL, Minas Gerais State, córrego do Marianinho. NUP 19138, 1, 35.2 mm SL, Minas Gerais State, córrego Frutal. ZUFMS-PIS 2358, 1, 20.5 mm SL, Mato Grosso do Sul State, córrego do Morgado.

***Aspidoras gabrieli* Wosiacki, Pereira & Reis, 2014**

Aspidoras gabrieli Wosiacki *et al.*, 2014: 309–316 (original description; type-locality: unnamed tributary to the left bank of the rio Parauapebas, tributary to the right bank of the rio Itacaiúnas, Pará State, Brazil). –Leão *et al.*, 2015: 585 (listed as comparative material). –Tencatt & Bichuette, 2017: 21 (listed as comparative material).

Diagnosis. *Aspidoras gabrieli* can be distinguished from its congeners, with exception of *A. albater*, *A. lakoi* and *Aspidoras* sp., by having inner laminar expansion of infraorbital 1 extremely well developed (*vs.* well developed in *A. depinnai*, *A. fuscoguttatus*; moderately or well developed in *A. poecilus*; moderately developed in *A. belenos*, *A. maculosus*, *A. mephisto* and *A. raimundi*; poorly developed in *A. psammatides* and *A. velites*); from *Aspidoras* sp. plus *A. depinnai*, *A. poecilus*, *A. psammatides*, *A. raimundi* and *A. velites* by presenting relatively wide frontal bone, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length in *A. depinnai*, *A. poecilus*, *A. raimundi*, *A. velites* and *Aspidoras* sp.; strongly narrow, with width conspicuously smaller than half of entire length in *A. psammatides*); from *A. albater* by having smoothly furcate caudal fin (*vs.* acutely), and dorsolateral body plates on predorsal region more distant from each counterpart (*vs.* touching or closer to each counterpart); from *A. lakoi* it differs by the absence of a pointed process on anterodorsal portion of infraorbital 1 (*vs.* presence).

Remarks. *Aspidoras gabrieli* was described based mainly on two diagnostic features: (I) rays and interradial membranes of the dorsal and pectoral fins densely pigmented, from base to tip

in young individuals, with a gradual reduction in pigmentation on the fin extremities over the course of ontogeny, though the base remains densely pigmented in larger individuals, and (II) inner bony margin of the pectoral spine expanded as a narrow laminar shelf with edge smooth or scarcely serrated. However, both features can also be observed in some *A. albater* specimens (see Figs. 13a,b, 37), which made it necessary to prepare a new diagnosis for it (see above). Despite *A. gabrieli* be remarkably similar to *A. albater* and also occurs in the rio Tocantins basin, it was possible to find at least two diagnostic features that distinguish *A. gabrieli* from it (see Diagnosis), and therefore is still considered as valid herein.

Material examined. MPEG 17394, 5 of 139, paratypes, 16.2±26.3 mm SL, Pará State, unnamed tributary to the left bank of the rio Parauapebas.

***Aspidoras kiriri* Oliveira, Zanata, Tencatt & Britto, 2017**

Aspidoras kiriri Oliveira *et al.*, 2017: e160118[1]–e160118[8] (original description; type-locality: riacho Cai-Camarão, Bahia State, Brazil).

Diagnosis. *Aspidoras kiriri* can be distinguished from its congeners, with exception of *A. belenos*, *A. raimundi* and *Aspidoras* sp., by having parapophysis of the complex vertebra well developed (*vs.* moderately developed in *A. depinnai*, *A. lakoi*, *A. maculosus*, *A. mephisto*, *A. poecilus*, *A. psammatides* and *A. velites*; poorly or moderately developed in *A. albater* and *A. fuscoguttatus*); it can be distinguished from *A. belenos* and *Aspidoras* sp. by the absence of small spots on dorsal fin (*vs.* presence); from *A. raimundi* by the presence of dark brown or black blotches on dorso- and/or ventrolateral body plates fused with flank midline blotches (*vs.* not fused).

Remarks. Although the description of *Aspidoras kiriri* is recent, the discovery of additional specimens revealed variations in one of its main diagnostic feature. The diagnosis proposed by Oliveira *et al.* (2017) considered that *A. kiriri* always presents infraorbital 1 with well-developed laminar expansion, whereas it was also possible to find specimens with moderately-developed expansion in the new material. Since this was their first step to differ *A. kiriri* from all of its congeners, the remaining steps of the diagnosis were also compromised. Therefore, in order to accurately recognize *A. kiriri* among its congeners, a new diagnosis was provided herein.

Material examined. In addition to the material listed by Oliveira *et al.* (2017: e160118[3]), the following specimens were analysed. All from Brazil, Bahia State, rio da Dona basin. MZFS 14872, 30 of 53, 15.9–31.3 mm SL, rio Itauá.

***Aspidoras lakoi* Miranda Ribeiro, 1949**

(Fig. 38)

Aspidoras lakoi Miranda Ribeiro, 1949: 143 (original description; type-locality: stream at the do Grotão Forest, da Cachoeira Farm, Minas Gerais State, Brazil). –Nijssen & Isbrücker, 1976: 113 (redescription). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison). –Leão *et al.*, 2015: 585 (listed as comparative material). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras lakoi* can be distinguished from all of its congeners by having the following features: anterodorsal portion of infraorbital 1 with a pointed process (see Fig. 39a,b) (*vs.* absence, see Fig. 39c) and parieto-supraoccipital fontanel slightly displaced towards anterior portion of parieto-supraoccipital (*vs.* located mesially or slightly displaced towards posterior portion of parieto-supraoccipital in *A. albater*; located close to origin of posterior process in *A. velites*; located mesially on parieto-supraoccipital in remaining congeners). Additionally, it differs from *A. belenos*, *A. depinnai*, *A. poecilus*, *A. psammatides*, *A. raimundi*, *A. velites* and *Aspidoras* sp. by presenting relatively wide frontal bone, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length in *A. depinnai*, *A. poecilus*, *A. raimundi*, *A. velites* and *Aspidoras* sp.; strongly narrow, with width conspicuously smaller than half of entire length in *A. psammatides*); from *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. maculosus*, *A. mephisto*, *A. poecilus*, *A. psammatides*, *A. raimundi* and *A. velites* by the presence of inner laminar expansion of infraorbital 1 extremely well developed (*vs.* well developed in *A. depinnai*; ranging from moderately developed to well developed in *A. fuscoguttatus* and *A. poecilus*; moderately developed in *A. belenos*, *A. maculosus*, *A. mephisto* and *A. raimundi*; poorly developed in *A. psammatides* and *A. velites*).

Description. Morphometric data presented in Table 5. Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout moderately developed and relatively pointed; more rounded in some specimens. Head profile convex from tip of snout to

anterior nares; region of frontal and/or parieto-supraoccipital slightly concave in some specimens; ascending slightly convex from this point to dorsal-fin origin. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance generally slightly smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to slightly surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming small semicircular or triangular fleshy flap. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip relatively long, equal to or slightly larger than 50% of entire bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, generally partially exposed; relatively large exposed area in some specimens. Nasal slender, curved laterally, inner margin generally with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border contacting only frontal; contacting frontal and mesethmoid in some specimens.

Frontal elongated, relatively wide, with width equal to or slightly larger than half of entire length (see Fig. 3b); anterior projection ranging from short, with size smaller than nasal length, to long, with size larger than nasal length; some areas of anterior margin covered by thick layer of skin in some specimens. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting

opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process poorly developed; not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; expanded posteriorly in some specimens, slightly surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; slightly displaced towards anterior portion of parieto-supraoccipital; fontanel occluded, reduced to a small fossa, in some specimens.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally moderately developed; poorly developed in specimens with about 20.0 mm SL or less; relatively well-developed in some specimens; anterior portion with laminar expansion ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule; anterodorsal portion with a pointed process (Fig. 39a,b); inner laminar expansion generally extremely well-developed (see Figs. 5a, 39a,b); external surface partially covered by thick layer of skin; infraorbital 2 small, slender to more compact; with posterior laminar expansion ranging from moderately to well developed; inner laminar expansion ranging from moderately- to well developed; posteroventral margin generally contacting posterodorsal ridge of hyomandibula; close but not directly contacting in some specimens; dorsal tip contacting only sphenotic; contacting sphenotic and compound pterotic in some specimens; presence of secondary laminar expansion on its posterodorsal portion in some specimens; small portions of external surface covered by thick layer of skin (Fig. 39a,b). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong, exposed; relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle exposed; covered by thick layer of skin in some specimens; covered by thinner layer of skin, externally visible; exposed areas generally bearing small odontodes. Interopercle with posterior portion exposed; almost entirely exposed in some specimens; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width clearly larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous;

ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; process strongly reduced in some specimens; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 22 to 30 (3) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular unciniate process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens. Upper tooth plate oval; 29 to 34 (2) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore generally fused with first pore. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and generally opening into two pores. Preoperculomandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening between suture of preopercle and posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third or fourth dorsolateral body plate. Dorsal-fin rays II,8 (14), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly- to moderately developed in length; generally, with posterior portion exposed; almost entirely exposed in some specimens; minute odontodes in exposed area (Fig. 40); spinelet extremely short or short, and generally partially exposed; spine ranging from poorly developed, with adpressed distal tip not reaching to middle portion of dorsal-fin base, to moderately developed, with adpressed distal tip slightly surpassing middle portion of dorsal-fin base;

anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,9* (16), I,10 (1); posterior margin of pectoral spine with nine to 21 poorly- or moderately-developed, serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; serrations only on distal half of pectoral-spine posterior margin in some specimens; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens (Fig. 41). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, generally externally visible. Pelvic fin oblong, generally located just below third or fourth ventrolateral body plate, and at vertical through fourth dorsal-fin branched ray. Pelvic-fin rays i,5* (17). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by nine to 11 dorsolateral body plates. Anal fin somewhat triangular, generally located just posterior to 15th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin with generally with eight rays (16); some specimens with ii,5,i (2) or ii,6 (3). Caudal-fin rays generally i,12,i (4); bilobed, dorsal lobe generally slightly larger than ventral lobe.

Two or three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal, if present, encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 26* (6), 27 (11); ventrolateral body plates 23* (3), 24 (14); dorsolateral body plates along dorsal-fin base 6* (14), 7 (3); dorsolateral body plates between adipose-fin spine and caudal-fin base 7* (8), 8 (9); preadipose platelets 6 (3), 7 (1), 8 (3), 9 (1), 10 (3), 11 (2), 12* (3), 13 (1); 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. Region between nuchal plate and posterior process of parieto-supraoccipital with relatively large platelets in some specimens.

Vertebral count 24 (1); ribs 7 (1), first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; with dark brown or

black diffuse stripe from anteroventral portion of eye to upper lip lateral area in some specimens; ventrolateral portion of snout with dark brown or black chromatophores in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens. Dorsal series of three to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, fourth, if present on middle portion of caudal peduncle, and fifth, if present, on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk, generally on region close to origins of pectoral and pelvic fins, and region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral body plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of generally four to five medium- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; blotches diffuse in some specimens. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, between dorsal and adipose fins, adipose-fin base, between adipose and base of caudal peduncle and base of caudal peduncle with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores; forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; fused to flank midline blotches in some specimens; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming longitudinal or oblique bars in some specimens; region of first and second branched rays with concentration of dark brown or black chromatophores on membranes in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black

chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; region of body around dorsal portion of pectoral-fin origin with concentration of dark brown or black chromatophores in some specimens. Pelvic fin generally with sparse dark brown or black chromatophores on its dorsal surface; region of body around dorsal portion of pelvic-fin origin with concentration of dark brown or black chromatophores in some specimens. Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one or two dark brown or black blotches in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black and generally slender bars.

Geographical distribution. *Aspidoras lakoi* is known only from the rio Grande basin, a tributary to the upper portion of the rio Paraná basin in Minas Gerais State (Fig. 9a).

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976: 113), except by the preparation of 3 CS specimens (disarticulated, indeterminate size) from MNRJ 5293, the following specimens were analysed. MNRJ 31639, 6, 16.3–38.5 mm SL, stream tributary of the left margin of the do Turvo Creek, Minas Gerais State, rio Grande basin.

***Aspidoras maculosus* Nijssen & Isbrücker, 1976**

(Figs. 42, 43)

Aspidoras maculosus Nijssen & Isbrücker, 1976: 119 (original description; type-locality: rio Paiaia, Bahia State, Brazil). –Reis, 2003: 292 (listed). –Britto *et al.*, 2005: 478 (morphological comparison). –Ferraris, 2007: 109 (listed). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras rochai (*non* Ihering, 1907) Ellis, 1913: 394 (listed; pl. XXVI, fig. 3; *partim*).

Diagnosis. *Aspidoras maculosus* can be distinguished from its congeners, with exception of *A. depinnai*, *A. fuscoguttatus*, *A. poecilus*, *A. raimundi* and *A. rochai*, by having anterior portion of infraorbital 1 with well-developed laminar expansion, surpassing middle of nasal capsule (*vs.* ranging from strongly reduced, at same level as posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. albater*; ranging from strongly reduced, not reaching to or at same level as posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. mephisto*; extremely well developed, reaching to or surpassing anterior margin of nasal capsule in *A. belenos*; ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. lakoi* and *Aspidoras* sp.; strongly reduced expansion, not reaching to or at same level as posterior margin of nasal capsule in *A. psammatides* and *A. velites*); it differs from *A. depinnai* by having small dark brown or black spots on dorsal fin (*vs.* absence); from *A. fuscoguttatus* by the following combination of features: presence of relatively large, well-defined dark brown or black blotches on top of the head (*vs.* absence), inner laminar expansion of infraorbital 1 moderately developed (*vs.* generally well developed), and a narrow frontal bone, with width slightly smaller than half of entire length (*vs.* generally relatively wide, with width equal to or slightly larger than half of entire length); from *A. poecilus* by the following combination of features: dark brown or black stripe from anteroventral portion of eye to upper lip lateral, when present, less evident (*vs.* generally present and more evident), and by dark brown or black large patches on dorsal fin generally absent (*vs.* generally present); from *A. raimundi* by having the following combination of features: absence of large and intensely pigmented dark brown or black blotch on dorsal fin (*vs.* generally present), and markings on ventrolateral body plates generally present and clearly more numerous, not considering the number of blotches in the series along flank midline (*vs.* markings, when present, clearly scarcer); from *A. rochai* by the presence of a narrow frontal bone, with width slightly smaller than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length).

Description. Morphometric data presented in Table 6; morphometric data of the holotype available in Nijssen & Isbrücker (1976: 110, table I). Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout moderately developed and rounded. Head profile convex from tip of snout to anterior nares; ascending slightly convex to nearly straight from this point to dorsal-fin origin; region of orbit and/or parieto-supraoccipital slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-

fin body profile slightly concave to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or slightly smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming small semicircular or triangular fleshy flap; with two triangular fleshy flaps in some specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip long, slightly larger than 50% of entire bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, entirely covered by thick layer of skin. Nasal slender, curved laterally, inner margin with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border generally contacting only frontal.

Frontal elongated, narrow, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection short, with size smaller than nasal length; some areas of anterior margin covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process strongly reduced to poorly developed; not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion not reaching tip of posterior process. Parieto-supraoccipital

fontanel small, roundish; located mesially on parieto-supraoccipital; fontanel occluded, reduced to a small fossa, in some specimens.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally extremely well developed; well developed in some specimens; anterior portion with well-developed laminar expansion, surpassing middle of nasal capsule (Fig. 44); inner laminar expansion moderately developed (see Fig. 5c); small portions of external surface covered by thick layer of skin; infraorbital 2 small, generally slender; slightly more compact in some specimens; generally with posterior laminar expansion moderately developed; or poorly developed; inner laminar expansion moderately developed; posteroventral margin contacting posterodorsal ridge of hyomandibula; dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 44). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed and relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thick layer of skin; covered by thin layer of skin, exposed, in some specimens; exposed areas generally bearing small odontodes. Interopercle with posterior portion generally exposed; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin smoothly irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 26 to 29 (1) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with rounded notch. Upper tooth plate oval; 32 to 36 (1) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel; slightly shorter; pore opening closer to supraorbital main canal in some specimens. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore generally fused with first pore; nasal canal with two openings in specimen UFBA 3291 (1 CS, 28.6 mm SL; apparently malformation). Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and generally opening into two pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,8 (12), II,9 (1), posterior margin of dorsal-fin spine smooth. Nuchal plate generally poorly developed in length and almost entirely exposed, with minute odontodes; anterior tip covered by thick layer of skin (Fig. 45); spinelet extremely short or short; partially exposed; spine poorly developed, adpressed distal tip reaching to middle portion of dorsal-fin base; or moderately developed, adpressed distal tip slightly surpassing middle portion of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,9 (13); posterior margin of pectoral spine with 12 to 17 moderately- to well-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays (Fig. 46). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third or fourth ventrolateral body plate, and at vertical through second or third dorsal-fin branched ray. Pelvic-fin rays i,5 (13). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by six to seven dorsolateral body plates. Anal fin somewhat

triangular, located just posterior to 12th, 13th or 14th ventrolateral body plates, and at vertical through origin of adipose-fin spine or region of preadipose platelets. Anal-fin rays ii,5,i (7), ii,6 (6). Caudal-fin rays i,12,i (13), generally five dorsal and/or ventral procurrent rays; bilobed, dorsal lobe generally slightly larger than ventral lobe.

Two to three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal, if present, encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 25 (5), 26 (7), 27 (1); ventrolateral body plates 22 (2), 23 (10), 24 (1); dorsolateral body plates along dorsal-fin base 6 (6), 7 (7); dorsolateral body plates between adipose-fin spine and caudal-fin base 8 (5), 9 (6), 10 (2); preadipose platelets 3 (5), 4 (4), 5 (4); 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. Anterior margin of orbit, above region of junction of frontal with lateral ethmoid, with small platelets. Ventral surface of trunk scarcely covered by small irregular or roundish platelets.

Vertebral count 24 (1); ribs 6 (1), first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores; relatively large rounded or irregular black blotches on top of head, becoming gradually smaller towards snout tip. Snout covered by dark brown or black chromatophores on its dorsal surface, generally forming dark brown or black rounded or irregular small spots; with diffuse dark brown or black stripe from anteroventral portion of eye to upper lip lateral area visible only in single juvenile specimen (MZUSP 88170, 15.4 mm SL); ventrolateral portion of snout with dark brown or black chromatophores in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens. Dorsal series of four to six dark brown or black blotches, first on anterior portion of dorsal-fin base, second, if present, on middle portion of dorsal-fin base, third on posterior portion of dorsal-fin base, fourth on adipose-fin base, fifth on middle portion of caudal peduncle and sixth, if present, on caudal-fin base; blotches diffuse

in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of body on region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of four to seven medium-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, between dorsal and adipose fins, adipose-fin base, between adipose and base of caudal peduncle and base of caudal peduncle with more concentrated chromatophores, forming conspicuous blotches in some specimens; fused to flank midline blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores; forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; fused to flank midline blotches in some specimens; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to pelvic-fin origin, in some specimens. Dorsal fin with dark brown or black spots; aligned spots, forming somewhat longitudinal or oblique rows in some specimens; small concentrations of dark brown or black chromatophores on some areas of membranes, not forming larger conspicuous dark brown or black patches, in some specimens; larger dark brown or black patch on middle portion of dorsal fin observed only in single juvenile specimen (MZUSP 88170, 15.4 mm SL); dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first, middle and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; forming dark brown or black spots, generally diffuse and more evident on first branched rays; or entirely hyaline; region of body around dorsal portion of pectoral-fin origin with dark brown or black chromatophores in some specimens. Pelvic fin generally with sparse dark brown or black chromatophores on its dorsal surface; forming up to two oblong dark brown or black patches in some specimens.

Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one to three dark brown or black blotches in some specimens; hyaline in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 47).

Geographical distribution. *Aspidoras maculosus* is known from the upper portion of the rio Itapicuru basin in Bahia State (Fig. 9b).

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976: 119), the following material was analysed. All from Brazil, Bahia State, Itapicuru River basin. MZUSP 88170, 9, 15.4–30.8 mm SL, Paiaia River. UFBA 3291, 2 of 5, 24.7–26.9 mm SL, 1 CS of 5, 30.7 mm SL, Paiaia River. UFBA 4660, 2, 23.4–24.2 mm SL, Itapicuru River.

***Aspidoras mephisto* Tencatt & Bichuette, 2017**

Aspidoras mephisto Tencatt & Bichuette, 2017: 1–24 (original description; type-locality: Anésio III cave, Goiás State, Brazil).

Diagnosis. Same as provided by Tencatt & Bichuette (2017: 8–9).

Material examined. Same as listed by Tencatt & Bichuette (2017: 3, 8).

***Aspidoras poecilus* Nijssen & Isbrücker, 1976**

(Fig. 48)

Aspidoras poecilus Nijssen & Isbrücker, 1976: 121 (original description; type-locality: creek upstream Porori Village, left bank of the rio Xingu, Mato Grosso State, Brazil). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Oliveira *et al.*, 2017: e160118[3] (morphological comparison; *partim*). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras microgalaeus Britto, 1998: 361 (original description; type-locality: creek at Primavera do Leste-Paranatinga road, Mato Grosso State, Brazil; new synonym). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Lima & Britto, 2001: 1015 (listed as comparative material). –Leão *et al.*, 2015: 578 (morphological comparison). –Tencatt & Bichuette, 2017: 21 (listed as comparative material).

Aspidoras marianae Leão, Britto & Wosiacki, 2015: 578 (original description; type-locality: unnamed stream tributary to the rio Curuá, Pará State, Brazil; new synonym). –Oliveira *et al.*, 2017: e160118[3] (morphological comparison). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras poecilus* can be distinguished from its congeners, with exception of *A. albater*, *A. belenos*, *A. depinnai*, *A. fuscoguttatus*, *A. kiriri*, *A. maculosus*, *A. mephisto*, *A. raimundi* and *Aspidoras* sp., by having inner laminar expansion of infraorbital 1 generally moderately developed; variably well developed (*vs.* extremely well developed in *A. gabrieli* and *A. lakoi*; poorly developed in *A. psammatides* and *A. velites*); from *A. albater* and *A. mephisto* by having a narrow frontal bone, with width slightly smaller than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length in *A. albater*); from *A. belenos*, *A. kiriri* and *Aspidoras* sp. by the presence of parapophysis of the complex vertebra moderately developed (*vs.* well developed); it differs from *A. depinnai* by the presence of the following combination of features: dark brown or black stripe from anteroventral portion of eye to upper lip lateral area generally present and more evident (*vs.* stripe, when present, less evident), and flanks generally with more numerous and/or evident dark brown or black markings, not considering the number of blotches in the series along flank midline (*vs.* flanks generally with fewer and/or less evident markings); from *A. fuscoguttatus* it differs by having the following combination of features: inner laminar expansion of infraorbital 1 generally moderately developed (*vs.* generally well-developed), flanks with clearly less dark brown or black markings, not considering the number of blotches in the series along flank midline (*vs.* clearly more markings), and generally more evident dark brown or black stripe from anteroventral portion of eye to upper lip lateral area (*vs.* generally less evident); from *A. maculosus* by the following combination of features: dark brown or black stripe from

anteroventral portion of eye to upper lip lateral area generally present and more evident (*vs.* generally absent, and, when present, less evident), and by dark brown or black large patches on dorsal fin generally present (*vs.* generally absent); and from *A. raimundi* by presenting the following combinations of features: dorsal fin generally with small dark brown or black small spots (*vs.* generally lacking small spots), and markings on ventrolateral body plates generally more numerous and more evident, not considering the number of blotches in the series along flank midline (*vs.* markings, when present, generally less numerous and less evident).

Description. Morphometric data presented in Table 7. Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout moderately developed and relatively rounded; snout short or more pointed in some specimens. Head profile convex from tip of snout to anterior nares; region of mesethmoid, frontal and/or parieto-supraoccipital slightly concave in some specimens; ascending slightly convex to nearly straight from this point to dorsal-fin origin. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave or nearly straight to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance ranging from slightly smaller to slightly larger than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming small semicircular or triangular fleshy flap; with two triangular fleshy flaps in some specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip ranging from short, slightly smaller than 50% of entire bone length, to long, slightly larger than 50% of entire bone length; posterior portion wide, generally entirely covered by thick layer of skin; partially exposed in some specimens. Nasal

slender, curved laterally, inner margin generally with moderately-developed laminar expansion; poorly developed in some specimens; outer margin with reduced laminar expansion; more developed in some specimens; mesial border contacting only frontal; or contacting frontal and mesethmoid.

Frontal elongated, relatively wide, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection ranging from short, with size slightly smaller than nasal length, to long, with size larger than nasal length; anterior margin partially or entirely covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process ranging from poorly developed to moderately developed; not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; expanded posteriorly in some specimens, slightly surpassing tip of posterior process; posterior portion not reaching tip of posterior process in some specimens. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital; fontanel occluded, reduced to a small fossa, in some specimens.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally ranging from well developed to strongly well developed; poorly or moderately developed in some specimens; anterior portion with laminar expansion ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule (Fig. 49); inner laminar expansion generally moderately developed (see Fig. 5c); single specimen with well-developed inner laminar expansion (LIRP 3972, 32.7 mm SL) (see Fig. 5b); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; generally with posterior laminar expansion poorly- to moderately-developed; relatively well-developed in specimen UNT 6234, 38.8 mm SL; inner laminar expansion poorly to moderately developed; posteroventral margin contacting posterodorsal ridge of hyomandibula; close but not directly contacting in some specimens; dorsal tip generally contacting only sphenotic; contacting sphenotic and compound

pterotic in specimen UNT 6234, 38.8 mm SL; small portions of external surface covered by thick layer of skin (Fig. 49). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong, exposed; relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle generally covered by thin layer of skin, exposed; or covered by relatively thick layer of skin, externally visible; or covered by thick layer of skin, not externally visible; exposed areas generally bearing small odontodes. Interopercle with posterior portion exposed; or entirely covered by thick layer of skin; or almost entirely exposed; somewhat triangular, anterior projection generally moderately developed; poorly developed in specimen UNT 12056, CS, 31.5 mm SL. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; process strongly reduced in some specimens; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 21 to 33 (8) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; process strongly reduced in some specimens; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens; two triangular expansions in some specimens. Upper tooth plate oval; 26 to 37 (8) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch moderately- to well-developed, with pore opening closer to anteroventral border of compound pterotic; or conspicuously reduced, with pore opening close to postotic main canal; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal

branch of supraorbital canal generally relatively long; pore opening close to frontal fontanel. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore fused with first pore in some specimens. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two or three pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,7 (2), II,8 (37), II,9 (1) posterior margin of dorsal-fin spine smooth; single specimen with three small serration-like structures (LBP 15860, 1 CS, 26.2 mm SL). Nuchal plate poorly to moderately developed in length; posterior portion exposed and with minute odontodes; anterior tip covered by thick layer of skin; almost entirely exposed in some specimens (Fig. 50); spinelet extremely short or short; partially exposed; spine ranging from poorly developed, with adpressed distal tip reaching to middle portion of dorsal-fin base, to relatively well developed, with adpressed distal tip slightly surpassing posterior origin of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,8 (37), I,8,i (1), I,9 (2); posterior margin of pectoral spine with 12 to 25 moderately- to well-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 51). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third, fourth or fifth ventrolateral body plate, and at vertical through second or third dorsal-fin branched ray. Pelvic-fin rays i,5 (40). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by seven to nine dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 12th, 13th or 14th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin rays ii,5 (2), ii,5,i (7), ii,6 (31). Caudal-fin rays i,12,i (40), five to seven dorsal and/or ventral procurrent rays; bilobed, lobes with similar size; dorsal lobe slightly larger than ventral lobe in some specimens.

Two to five laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third, fourth and fifth lateral-line canals, if present, encased in third, fourth and fifth dorsolateral body

plates, respectively. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 24 (6), 25 (26), 26 (7), 28 (1); ventrolateral body plates 21 (3), 22 (21), 23 (15), 25 (1); dorsolateral body plates along dorsal-fin base 6 (37), 7 (3); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (17), 8 (21), 9 (2); preadipose platelets 3 (12), 4 (13), 5 (10), 6 (3), 7 (2); 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. Anterior margin of orbit, above region of junction of frontal with lateral ethmoid, with small platelets; platelets absent in some specimens. Ventrolateral portion of snout, region of nasal capsule and dorsal portion of snout, above mesethmoid, with small platelets in some specimens (Fig. 49c). Region between nuchal plate and posterior process of parieto-supraoccipital with small to relatively large platelets in some specimens (Fig. 50b). Ventral surface of trunk densely covered by small irregular platelets; sparser platelets in some specimens.

Vertebral count 23 (5). 24 (3); ribs 6 (7), first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores; generally, with relatively large rounded or irregular black blotches on top of head. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; generally forming dark brown or black rounded, striated or irregular spots; generally, with dark brown or black diffuse or conspicuous stripe from anteroventral portion of eye to upper lip lateral area; ventrolateral portion of snout with dark brown or black chromatophores, variably forming spots, in some specimens; spots diffuse or absent in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip generally with conspicuous concentration of dark brown or black chromatophores; outer mental barbel with dark brown or black chromatophores, generally more evident on its proximal portion, in some specimens; region of isthmus around lower lip with dark brown or black chromatophores in some specimens. Dorsal series of three to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, fourth, if present, on middle portion of caudal peduncle, and fifth, if present, on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of

dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk and region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of four to six medium- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; blotches fused with each other, forming larger longitudinally elongated blotch in some specimens. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, adipose-fin base, and base of caudal peduncle generally with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores; forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black small spots; spots longitudinally or obliquely aligned, forming bars in some specimens; with two rows of aligned spots in some specimens; non-aligned spots in some specimens; with conspicuous concentration of dark brown or black chromatophores on some areas of membranes, mainly on anterior portion of fin, forming larger dark brown or black patches in some specimens; small spots absent in some specimens, with large dark brown or black conspicuous blotch on middle portion of fin in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; covered by dark brown or black spots in some specimens; spots generally diffuse and more evident on first branched rays; region of body around dorsal portion of pectoral-fin origin with concentration of dark brown or black chromatophores in some specimens. Pelvic fin with dark brown or black chromatophores on its dorsal surface; hyaline in some specimens. Adipose-fin membrane with dark brown or black chromatophores; conspicuous concentration of dark brown

or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one or two dark brown or black blotches in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender to thick bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 52).

Geographical distribution. *Aspidoras poecilus* is known from the rio Araguaia basin in Mato Grosso, rio Tocantins basin in Goiás and Tocantins states, rio Tapajós basin in Mato Grosso State, and rio Xingu basin in Mato Grosso and Pará states (Fig. 9b).

Remarks. *Aspidoras poecilus* was originally described from the Xingu River basin, in Mato Grosso State, and from the Araguaia River basin, in Goiás State. Despite Nijssen & Isbrücker (1976: 121) stated that the type locality of this species is a tributary to the Xingu River near the border Mato Grosso-Pará, Leão *et al.* (2015: 583) discussed a possible error regarding this information, since only the holotype was collected there, whereas the paratypes and additional non-type specimens are all from the Araguaia River basin. However, this argument alone is not enough to conclude this. The material examined herein resulted in the discovery of a single specimen collected in the region of the type locality (MNRJ 33855), which fits the holotype. Considering this, there is no plausible reason to refute the type locality provided by Nijssen & Isbrücker (1976). Additionally, the analysis of specimens from the Araguaia River basin in Mato Grosso State also confirmed the presence of *A. poecilus*, corroborating the geographic distribution provided in the original description.

Based on the holotype and this single additional specimen, it was possible to observe some osteological features of the typical *A. poecilus*, characterized by ventral laminar expansion of infraorbital 1 well developed, posterior margin of pectoral spine with moderately-developed serrations, and nuchal plate with anterior tip relatively close to posterior tip of the parieto-supraoccipital. This general morphological pattern can be observed in most specimens from the

Araguaia River basin, but with some specimens presenting ventral laminar expansion of infraorbital 1 poorly developed (LBP 4019, in one of the 18 examined), moderately developed (LBP 4019, in one of the 18 examined) or strongly developed (LBP 20797, in two of the 14 examined, and LBP 4019, in five of the 18 examined). In general, the color pattern of the typical *A. poecilus* is also observed in specimens from the Araguaia River basin, except for the presence of some specimens with anterior portion of dorsal fin with concentration of dark brown or black chromatophores and/or non-aligned spots on dorsal fin (Fig. 53a). Since most specimens present the osteological pattern of the typical *A. poecilus*, including individuals with or without the typical dorsal-fin color pattern, and considering that the ventral laminar expansion of infraorbital presents a gradative variation, ranging from poorly to strongly well developed but with two intermediary stages (moderately and well developed), there is no plausible reason to consider the population from the Araguaia River basin as a distinct species.

Britto (1998) described *Aspidoras microgaleus* (Fig. 54) from a tributary to the Culuene River, itself a tributary to the Xingu River basin in Mato Grosso State. The analysis of several specimens from this region, including type material, revealed some incongruities between the examined material and the information provided in the original description. According to Britto (1998: 362, fig. 4b), there is a relatively large distance between nuchal plate and posterior tip of parieto-supraoccipital, which was initially considered one of the diagnostic feature between *A. microgaleus* and *A. poecilus*. However, the analysis of CS specimens showed that both structures are clearly closer to each other. A plausible explanation for this discrepancy is that Britto (1998) interpreted this feature based only on non-CS specimens, in which the anterior portion of nuchal plate and the posterior tip of parieto-supraoccipital are covered by thick layer of skin.

In the original description, the infraorbital 1 of *A. microgaleus* was depicted with a moderately-developed ventral laminar expansion and a poorly-developed anterior laminar expansion (see Britto, 1998: 363, fig. 5b). Despite most specimens presents ventral laminar expansion of infraorbital 1 moderately developed, specimens with poorly or well developed expansions are also present, overlapping with *A. poecilus* range. Regarding the anterior portion of the infraorbital 1, it was also possible to observe some degree of variation, which ranged from poorly developed to moderately developed. Although typical *A. poecilus* generally presents anterior laminar expansion of infraorbital ranging from well developed to extremely well developed, some specimens from the Araguaia River basin displayed a moderately-developed expansion, and therefore it can not be considered as a diagnostic feature. Also, as observed in typical *A. poecilus*, most specimens of *A. microgaleus* presents inner laminar

expansion of infraorbital 1 moderately developed, with exception of a single specimen (LIRP 3972, 32.7 mm SL), which presents a well-developed expansion. The pectoral-fin spine of *A. microgalaesus* was also illustrated by Britto (1998: 363, fig. 6a), displaying moderately-developed serrations on its posterior margin. As typically seen in *A. poecilus*, most examined specimens of *A. microgalaesus* indeed present moderately developed serrations (Fig. 51), although some specimens present well-developed serrations (Fig. 51).

Regarding color pattern, Britto (1998: 367) stated that *A. microgalaesus* presents five to six blotches along midline of flank, but it is possible to see that some paratypes (see Britto, 1998: 365, fig. 8) and non-type specimens present four blotches, similar to what is observed in the typical *A. poecilus* (left and right sides of the holotype with four and five blotches, respectively, and four blotches in both sides of specimen of MNRJ 33855). Also as in *A. poecilus*, many specimens of *A. microgalaesus* present dorsal fin with longitudinally or obliquely aligned spots, with concentration of dark brown or black chromatophores on membranes, forming longitudinal or oblique bar (Fig. 52b). In general, the only difference between both species is that part of the *A. microgalaesus* specimens present a densely mottled body (Fig. 52b), contrary to the typical *A. poecilus*, that presents a less mottled pattern (Figs. 48, 53). However, since both osteologic and color patterns presented overlappings and no conspicuous diagnostic feature were observed, *A. microgalaesus* is placed in the synonymy of *A. poecilus*.

Aspidoras marianae Leão, Britto & Wosiacki, 2015 was recently described from the Curuá River basin, a tributary to the Xingu River basin in Pará State. According to its original description (Leão *et al.*, 2015: 578), this species can be distinguished from all congeners by having small odontode-bearing platelets on snout. Despite of that, this feature was also observed in *A. albater*, *A. belenos*, *A. fuscoguttatus*, *A. poecilus*, *A. psammaticides* and *A. raimundi*, and is thus not diagnostic considering all congeners. The authors also stated that the species can be distinguished from its congeners, except *A. taurus*, by having infraorbitals covered by thick layer of skin, not externally visible, and from *A. taurus* by having small platelets on the region between tip of parieto-supraoccipital process and the anterior tip of nuchal plate. As previously discussed, *A. taurus* is a synonym of *A. albater* and, in fact, the infraorbital 2 of some *A. albater* specimens can be entirely covered by thick layer of skin, but this is not the case of infraorbital 1, which is partially exposed (see Remarks for *A. albater*). However, Leão *et al.* (2015: 582, fig. 3) provided a photo showing both infraorbitals in a CS paratype, in which it is possible to see that only small portions of these bones are covered by a thick layer of skin, being almost entirely exposed. Additionally, the platelets between parieto-supraoccipital process and nuchal

plate are not only present in *A. albater* but also in *A. fuscoguttatus*, *A. kiriri*, *A. lakoi*, *A. poecilus* and *A. raimundi*.

The analysis of specimens from the Curuá River basin in Pará, clearly compatible to *A. marianae*, allowed us to confirm the presence of the following features: (I) small platelets on the snout, although sparser, (II) infraorbitals 1 and 2 almost entirely exposed, and (III) medium-sized to relatively large platelets between parieto-supraoccipital process and nuchal plate. Additionally, it was possible to observe the presence of infraorbital 1 with ventral and anterior laminar expansions generally extremely well developed, and with a moderately-developed inner laminar expansion; narrow frontal bone; parapophysis of complex vertebra moderately developed; dorsal fin with dark brown or black spots, variably longitudinally or obliquely aligned, with concentration of dark brown or black chromatophores on membranes, forming longitudinal or oblique bar in some specimens; anterior portion of dorsal fin variably with concentration of dark brown or black chromatophores; and markings on ventrolateral body plates relatively numerous and evident, not considering the number of blotches in the series along flank midline. Since the combination of these features is, basically, the diagnosis of *A. poecilus*, and no additional conspicuous diagnostic feature differing this population from the typical *A. poecilus* was observed, *A. marianae* is also placed under its synonymy.

Some populations from the Tocantins River basin in Goiás and Tocantins states (Fig. 53b), and the Tapajós River basin in Mato Grosso State (Fig. 53c) also presented a similar variation pattern in osteologic and coloration features to specimens from the rivers Araguaia and Culuene basins. By this reason, these populations will also be attributed to *A. poecilus*. Nijssen & Isbrücker (1976) reported the presence of a possible new species similar to *A. poecilus*, which they called *Aspidoras* sp. aff. *poecilus*. Although it was not possible to reanalyse this material, that is basically from the Tocantins River basin in Goiás State, several specimens from this region were examined, revealing the presence of *A. albater* and *A. poecilus*. Therefore, it is quite possible that the material listed by Nijssen & Isbrücker (1976: 122) includes at least one of these species, which can only be confirmed through its reexamination.

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976: 121), the following material was analysed. All from Brazil. CPUFMT 2060, 5, 12.1–27.7 mm SL, 1 CS, 27.6 mm SL, Pará State, unnamed stream tributary to the rio Curuá, rio Xingu basin. LBP 4019, 18, 15.6–28.4 mm SL, Mato Grosso State, córrego Taquaralzinho, rio Araguaia basin. LBP 15714, 34 of 35, 12.9–25.2 mm SL, 1 CS of 35, 26.0 mm SL, Mato Grosso State, unnamed stream tributary to the rio Suiazinho, rio Xingu basin. LBP 15732, 3, 20.8–29.6 mm SL, Mato

Grosso State, unnamed stream tributary to the ribeirão Manda Brasa, rio Xingu basin. LBP 15850, 33, 17.5–35.0 mm SL, Mato Grosso State, unnamed stream tributary to the rio Suiá-Miçu, rio Xingu basin. LBP 15860, 5 of 6, 14.1–26.2 mm SL, 1 CS of 6, 26.2 mm SL, Mato Grosso State, unnamed stream tributary to the ribeirão Tangurinho, rio Xingu basin. LBP 15895, 31 of 32, 15.5–30.2 mm SL, 1 CS of 32, 27.1 mm SL, Mato Grosso State, unnamed stream tributary to the rio Tanguro, rio Xingu basin. LBP 19126, 15, 14.7–29.9 mm SL, Goiás State, rio Ubiraxama, rio Tocantins basin. LBP 20797, 14, 18.0–25.0 mm SL, Mato Grosso State, córrego Taquaralzinho, rio Araguaia basin. LIRP 3972, 1, 32.7 mm SL, Mato Grosso State, unnamed stream tributary to the rio Culuene, rio Xingu basin. LIRP 11103, 6, 17.4–25.2 mm SL, Tocantins State, córrego Presídio, rio Tocantins basin. MNRJ 23536, 1, 18.5 mm SL, Mato Grosso State, rio Braço Dois, rio Tapajós basin. MNRJ 24624, 1, 18.6 mm SL, Mato Grosso State, córrego Doce, rio Tapajós basin. MNRJ 24640, 2, 25.2–28.0 mm SL, Mato Grosso State, unnamed stream tributary to the rio Peixoto de Azevedo, rio Tapajós basin. MNRJ 33854, 1, 20.2 mm SL, Pará State, córrego dos Maias, rio Xingu basin. MNRJ 33855, 1, 19.1 mm SL, Mato Grosso State, unnamed stream, rio Xingu basin. MNRJ 33856, 2 of 22, 20.5–22.9 mm SL, Mato Grosso State, unnamed stream, rio Tapajós basin. MNRJ 33857, 2, 16.8–19.4 mm SL, Mato Grosso State, rio Cristalino, rio Tapajós basin. MNRJ 33858, 1, 23.3 mm SL, Mato Grosso State, rio Cristalino, rio Tapajós basin. MZUSP 62609, 4, 18.0–19.8 mm SL, Mato Grosso State, ribeirão Suiazinho, rio Xingu basin. MZUSP 62611, 8, 8.1–18.0 mm SL, Mato Grosso State, córrego Piabanha, rio Xingu basin. MZUSP 62612, 6, 9.9–22.3 mm SL, Mato Grosso State, córrego Piabanha, rio Xingu basin. MZUSP 86836, 11, 14.6–24.2 mm SL, Mato Grosso State, rio Tanguro, rio Xingu basin. MZUSP 86842, 74 of 75, 14.5–27.0 mm SL, Mato Grosso State, córrego Formoso, rio Xingu basin. MZUSP 86856, 28 of 48, 9.5–27.8 mm SL, Mato Grosso State, stream tributary to the rio Suiá-Miçu, rio Xingu basin. MZUSP 87152, 8 of 18, 18.4–21.2 mm SL, Mato Grosso State, rio Suiazinho, rio Xingu basin. MZUSP 87153, 24, 14.7–22.9 mm SL, Mato Grosso State, córrego Capim, rio Xingu basin. MZUSP 95587, 4, 18.9–22.8 mm SL, Mato Grosso State, rio Coronel Vanick. MZUSP 97074, 1, 24.3 mm SL, Mato Grosso State, córrego Água Fria, rio Xingu basin. MZUSP 97759, 1, 29.2 mm SL, Mato Grosso State, rio Tanguro, rio Xingu basin. MZUSP 97789, 1, 22.3 mm SL, Mato Grosso State, unnamed stream crossing the road MT110, rio Xingu basin. MZUSP 97887, 1, 21.9 mm SL, Mato Grosso State, córrego Tangará, rio Xingu basin. MZUSP 98011, 13, 19.1–28.8 mm SL, Mato Grosso State, stream tributary to a marginal lagoon of the rio Couto de Magalhães, rio Xingu basin. MZUSP 98064, 5 of 15, 22.2–24.2 mm SL, Mato Grosso State, córrego Água Limpa, rio Xingu basin. MZUSP 98084, 2, 21.8–27.0 mm SL, Mato Grosso State, unnamed

stream tributary to the rio Couto de Magalhães, rio Xingu basin. MZUSP 116625, 17, 15.6–28.6 mm SL, Pará State, stream tributary to the rio Curuá, rio Xingu basin. NUP 19123, 4, 22.3–29.0 mm SL, Mato Grosso State, córrego Fogaça, rio Araguaia basin. UNT 5531, 6, 15.4–22.0 mm SL, Tocantins State, rio Tocantins, rio Tocantins basin. UNT 5535, 6, 10.5–28.8 mm SL, Tocantins State, córrego Bufú, rio Tocantins basin. UNT 5548, 9 of 10, 16.4–22.9 mm SL, 1 CS, 23.0 mm SL, Tocantins State, córrego Fundo, rio Tocantins basin. UNT 6234, 29 of 51, 24.9–38.8 mm SL, 1 CS of 51, 33.1 mm SL, Tocantins State, córrego dos Vidros, rio Tocantins basin. UNT 6249, 29 of 46, 20.4–32.8 mm SL, 1 CS of 46, 30.9 mm SL, Tocantins State, ribeirão Manduca, rio Tocantins basin. UNT 11401, 6, 15.0–18.7 mm SL, Tocantins State, rio Areias, rio Tocantins basin. UNT 12056, 3 of 4, 18.8–32.4 mm SL, 1 CS of 4, 31.5 mm SL, Tocantins State, unnamed stream, rio Tocantins basin. UNT 12251, 2, 19.2–21.2 mm SL, Tocantins State, córrego Pontal and ribeirão Carmo, rio Tocantins basin.

***Aspidoras psammatides* Britto, Lima & Santos, 2005**

(Fig. 55)

Aspidoras psammatides Britto, Lima & Santos, 2005:473–479 (original description; type-locality: Caldeirão River, Bahia State, Brazil). –Ferraris, 2007: 110 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison). –Leão *et al.*, 2015: 585 (listed as comparative material). –Tencatt & Bichuette, 2017: 21 (listed as comparative material).

Diagnosis. *Aspidoras psammatides* can be distinguished from all of its congeners by having strongly narrow frontal bone, with width conspicuously smaller than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length in *A. albater*, *A. lakoi*, *A. mephisto* and *A. rochai*; narrow, with width slightly smaller than half of entire length in *A. depinnai*, *A. poecilus*, *A. raimundi* and *A. velites*; ranging from narrow, with width slightly smaller than half of entire length, to relatively thick, with width equal to or slightly larger than half of entire length in *A. fuscoguttatus*). Additionally, *A. psammatides* can be distinguished from its congeners, except for *A. albater*, *A. mephisto* and *A. velites*, by having anterior portion of infraorbital 1 with strongly reduced laminar expansion, not reaching to or at same level as posterior margin of nasal capsule (*vs.* extremely well developed, reaching to or surpassing anterior margin of nasal capsule in *A. belenos*; well developed, surpassing middle of nasal capsule in *A. depinnai*, *A. maculosus* and *A. rochai*; ranging from well developed, surpassing middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule in *A. fuscoguttatus*; ranging from well developed, surpassing middle of nasal capsule,

to extremely well developed, reaching to or surpassing anterior margin of nasal capsule in *A. kiriri*; ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. lakoi* and *Aspidoras* sp.; laminar expansion ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule in *A. poecilus*; laminar expansion ranging from moderately developed, reaching to middle of nasal capsule, to extremely well-developed, reaching to anterior margin of nasal capsule in *A. raimundi*); it can be distinguished from *A. albater* and *A. mephisto* by having inner laminar expansion of infraorbital 1 poorly developed (*vs.* expansion ranging from well developed to extremely well developed in *A. albater*; moderately developed in *A. mephisto*); from *A. velites* by the presence of dorsal-fin spinelet (*vs.* absence).

Description. Morphometric data available in Britto *et al.* (2005: 475, table 1). Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout well-developed and pointed; moderately developed and more rounded in some specimens. Head profile convex from tip of snout to anterior nares; ascending slightly convex to nearly straight from this point to dorsal-fin origin; dorsal margin of orbit generally slightly elevated; region of parieto-supraoccipital slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave or nearly straight to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body acutely elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to or smaller than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to relatively large in size, not reaching to anteroventral limit of gill opening. Outer mental barbell ranging from slightly smaller to slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip relatively well developed, forming moderately-developed triangular fleshy flap; or lower lip moderately developed,

forming small semicircular fleshy flap. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip long, larger than 50% of entire bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, generally entirely covered by thick layer of skin; posterior portion partially exposed in some specimens. Nasal slender, curved laterally, inner margin generally with poorly-developed laminar expansion; outer margin with reduced laminar expansion; absent in some specimens; mesial border generally contacting frontal and mesethmoid.

Frontal elongated, strongly narrow, with width clearly smaller than half of entire length (see Fig. 3c); anterior projection short, with size clearly smaller than nasal length; some areas of anterior margin covered by thick layer of skin in some specimens. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process poorly developed, not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion not reaching tip of posterior process. Parieto-supraoccipital fontanel small, roundish or ellipsoid; located mesially on parieto-supraoccipital.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion generally poorly developed; almost reduced to latero-sensory canal in some specimens; anterior portion with strongly reduced laminar expansion, not reaching to or at same level as posterior margin of nasal capsule (Fig. 56); inner laminar expansion poorly developed (see Fig. 5d); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; posterior laminar expansion generally poorly developed; almost reduced to latero-sensory canal in some specimens; inner laminar expansion poorly developed; posteroventral margin close but not directly contacting posterodorsal ridge of hyomandibula; contacting in some specimens; dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 56). Posterodorsal ridge of hyomandibula close to

its articulation with opercle oblong, exposed; relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thick layer of skin; exposed areas generally bearing small odontodes. Interopercle entirely covered by thick layer of skin; somewhat triangular, anterior projection moderately developed. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion well developed, about twice size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; ceratobranchial 5 toothed on postero-dorsal surface, 22 to 29 (5) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens. Upper tooth plate oval; 28 to 34 (5) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel. Nasal canal with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore fused with first pore in some specimens. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and generally opening into two pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs

through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to second or third dorsolateral body plate. Dorsal-fin rays II,8* (52), posterior margin of dorsal-fin spine smooth. Nuchal plate generally moderately developed in length and almost entirely exposed, bearing minute odontodes (Fig. 57); spinelet generally short and partially exposed; spine moderately developed, adpressed distal tip surpassing middle portion of dorsal-fin base; or relatively well developed, adpressed distal tip slightly surpassing posterior origin of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,9* (27), I,10 (25); posterior margin of pectoral spine with 18 to 19 moderately-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 58). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third or fourth ventrolateral body plate, and at vertical through second dorsal-fin branched ray. Pelvic-fin rays i,5* (52). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by seven to nine dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 14th or 15th ventrolateral body plates, and at vertical generally through origin of adipose-fin spine; or at vertical through region of preadipose platelets. Anal-fin rays ii,4,i (1), ii,5,i* (51). Caudal-fin rays i,11,i (1), i,12,i* (51), generally four dorsal and/or ventral procurrent rays; bilobed, lobes with similar size.

Generally, three laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third lateral-line canal encased in third dorsolateral body plate. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 26 (2), 27* (24), 28 (24), 29 (2); ventrolateral body plates 24 (19), 25* (25), 26 (8); dorsolateral body plates along dorsal-fin base 6 (12), 7* (40); dorsolateral body plates between adipose-fin spine and caudal-fin base 8 (2), 9 (8), 10* (23), 11 (18), 12 (1); preadipose platelets 2 (1), 3 (11), 4* (35), 5 (4), 6 (1); 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. Anterior margin of orbit, above region of junction of frontal with lateral ethmoid, generally

with small platelets; anterodorsal portion of orbit generally with small platelets. Ventrolateral portion of head with small platelets in some specimens. Ventral surface of trunk scarcely covered by small platelets, generally more abundant and/or concentrated on region of pectoral girdle; absence of platelets in some specimens.

Vertebral count 25 (3), 26 (4); ribs 5 (6), 7 (1) first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; forming dark brown or black rounded, striated or irregular spots in some specimens; generally, with dark brown or black diffuse or conspicuous stripe from anteroventral portion of eye to upper lip lateral area. Upper lip and maxillary barbel with dark brown or black chromatophores; or absence of chromatophores in these areas; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel generally lacking chromatophores. Dorsal series of four to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, fourth, if present, middle portion of caudal peduncle, and fifth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk and region posterior to urogenital opening generally lacking dark brown or black chromatophores; region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate generally with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorsolateral plates and region of lateral line canals with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with longitudinal series of five to ten small- to medium-sized conspicuous dark brown or black blotches; diffuse in some specimens; blotches rounded, oblong or irregular. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, adipose-fin base, between adipose and base of caudal peduncle and base of caudal peduncle with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black

chromatophores, generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores, generally more evident posteriorly to pelvic-fin origin; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin with dark brown or black chromatophores, generally restricted to rays; almost entirely hyaline in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine generally covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; or almost entirely hyaline; region of body around dorsal portion of pectoral-fin origin with concentration of dark brown or black chromatophores in some specimens. Pelvic fin generally hyaline. Adipose-fin membrane with dark brown or black chromatophores, generally more evident close to spine; almost entirely hyaline in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin entirely or almost entirely hyaline; scarce dark brown or black chromatophores, generally restricted to bases of last branched rays in some specimens. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with dark brown or black chromatophores, generally forming two to five small bars restricted to outermost rays of both lobes; small bars from dorsal and ventral lobes connected in some specimens, forming clearly slender transversal large bars; almost entirely hyaline in some specimens.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 59).

Geographical distribution. *Aspidoras psammaticus* is known only from the upper portion of the Paraguaçu River basin in Bahia State (Fig. 9b).

Material examined. In addition to the specimens examined by Britto *et al.* (2005: 474), the following material was analysed. All from Brazil, Bahia State, rio Paraguaçu basin. MZFS 2701, 20 of 36, 17.8–28.7 mm SL, rio São José. MZFS 3955, 16, 17.9–28.2 mm SL, rio São José. MZUSP 49245, 7, 21.7–25.0 mm SL, Una River. MZUSP 93285, 22 of 27, 16.8–28.1 mm

SL, rio Capivara. MZUSP 120465, 5, 21.6–28.4 mm SL, rio Capivara. MZUSP 120469, 19, 14.4–20.9 mm SL, ribeirão de Baixo. MZUSP 120533, 49, 18.6–27.7 mm SL, rio Capivara. UFBA 3678, 4 of 77, 15.9–18.3 mm SL, rio da Invernada. UNT 9604, 18 of 40, 16.9–23.3 mm SL, 2 CS of 40, 23.2–27.3 mm SL, rio Roncador.

***Aspidoras raimundi* (Steindachner, 1907)**

(Fig. 60)

Aspidoras raimundi Steindachner, 1907: 84 (original description; type-locality: at mouth of brook emptying into Parnahyba [= Parnaíba] River near Victoria [Alto Parnaíba], Maranhão State, Brazil). –Lima & Britto, 2001: 1015 (listed as comparative material). –Reis, 2003: 292 (listed). –Ferraris, 2007: 110 (listed). –Oliveira *et al.*, 2017: e160118[3] (morphological comparison). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras menezesi Nijssen & Isbrücker, 1976: 120 (original description; type-locality: Granjeiro River at Crato, Ceará State, Brazil; new synonym). –Reis, 2003: 292 (listed). –Ferraris, 2007: 109 (listed). –Oliveira *et al.*, 2017: e160118[3] (morphological comparison; *partim*). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Aspidoras aff. *menezesi* (Nijssen & Isbrücker, 1976): –Britto, 2000: 1054 (listed as comparative material). –Lima & Britto, 2001: 1015 (listed as comparative material).

Aspidoras spilotus Nijssen & Isbrücker, 1976: 123 (original description; type-locality: dos Macacos Stream, tributary to the Acaraú River, Ceará State, Brazil; new synonym). –Britto, 1998: 361 (listed as comparative material). –Britto, 2000: 1054 (listed as comparative material). –Leão *et al.*, 2015: 586 (listed as comparative material). –Reis, 2003: 292 (listed). –Ferraris, 2007: 110 (listed). –Oliveira *et al.*, 2017: e160118[3] (morphological comparison). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras raimundi* can be distinguished from its congeners, with exception of *A. belenos*, *A. fuscoguttatus*, *A. kiriri*, *A. maculosus*, *A. mephisto* and *A. poecilus*, by having inner laminar expansion of infraorbital 1 moderately developed (*vs.* ranging from well developed to extremely well developed in *A. albater* and *Aspidoras* sp.; well developed in *A. depinnai*; extremely well developed in *A. gabrieli* and *A. lakoi*; poorly developed in *A. psammatides* and *A. velites*); from *A. kiriri* by the absence of dark brown or black blotches on dorso- and ventrolateral body plates fused with flank midline blotches (*vs.* presence); it can be distinguished from *A. mephisto* by having a narrow frontal bone, with width slightly smaller

than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length); it can be distinguished from *A. belenos* by having the following combination of features: large and intensely pigmented dark brown or black blotch on dorsal fin generally present (*vs.* absent), parapophysis of complex vertebra generally moderately developed (*vs.* well developed), and markings on ventrolateral body plates, when present, clearly scarcer, not considering the number of blotches in the series along flank midline (*vs.* markings generally present and clearly more numerous); from *A. maculosus* and *A. poecilus* it differs by having the following combination of features: dorsal fin generally lacking small dark brown or black spots (*vs.* always present in *A. maculosus*; generally present in *A. poecilus*), and dark brown or black markings on ventrolateral body plates, when present, scarcer, not considering the number of blotches in the series along flank midline (*vs.* markings generally present and more numerous).

Description. Morphometric data presented in Table 8. Head compressed with convex dorsal profile; somewhat triangular or trapezoid in dorsal view. Snout ranging from short to relatively well-developed, and from rounded to pointed. Head profile convex from tip of snout to anterior nares; region of mesethmoid, frontal and/or parieto-supraoccipital slightly concave in some specimens; ascending slightly convex to nearly straight from this point to dorsal-fin origin. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave or nearly straight to adipose-fin spine; slightly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; slightly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance ranging from slightly smaller to slightly larger than naris diameter. Mouth small, subterminal, width larger than bony orbit diameter. Maxillary barbel moderate to large in size, ranging from not reaching to surpassing anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip moderately developed, forming small semicircular or triangular fleshy flap; with two triangular fleshy flaps in some

specimens. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip ranging from short, slightly smaller than 50% of entire bone length, to long, slightly larger than 50% of entire bone length; posterior portion wide, generally entirely covered by thick layer of skin; small portions exposed in some specimens. Nasal slender, curved laterally, inner margin with poorly- to moderately-developed laminar expansion; outer margin generally with reduced laminar expansion; more developed in some specimens; mesial border generally contacting only frontal; contacting frontal and mesethmoid in some specimens.

Frontal elongated, narrow, with width slightly smaller than half of entire length (see Fig. 3a); anterior projection ranging from short, with size slightly smaller than nasal length, to long, with size larger than nasal length; anterior margin partially or entirely covered by thick layer of skin. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital wide, posterior process ranging from poorly developed to moderately developed; not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion at same level as posterior process tip; posterior portion not reaching tip of posterior process in some specimens; expanded posteriorly in some specimens, slightly surpassing tip of posterior process. Parieto-supraoccipital fontanel small, roundish; located mesially on parieto-supraoccipital; fontanel occluded, reduced to a small fossa, in some specimens.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion ranging from moderately to strongly well-developed; anterior portion with laminar expansion ranging from moderately developed, reaching to middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule (Fig. 61); inner laminar expansion moderately developed (see Fig. 5c); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion generally

poorly developed; strongly reduced in some specimens; inner laminar expansion moderately developed; posteroventral margin contacting posterodorsal ridge of hyomandibula; close but not directly contacting in some specimens; dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 61). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong, exposed; relatively slender; dorsal ridge of hyomandibula between compound pterotic and opercle generally covered by thick layer of skin, not externally visible; or covered by relatively thick layer of skin, externally visible; or covered by thin layer of skin, exposed; exposed areas generally bearing small odontodes. Interopercle with posterior portion generally exposed; somewhat triangular, anterior projection generally moderately developed; relatively well developed in some specimens. Preopercle relatively slender, elongated, minute odontodes sparse on external surface. Opercle compact in shape, width larger than half of its length; free margin convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion generally well developed, about twice size of cartilaginous portion; strongly developed, about triple size of cartilaginous portion in some specimens. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; process strongly reduced in some specimens; ceratobranchial 3 generally with continuous postero-lateral margin; variably notched; ceratobranchial 5 toothed on posterodorsal surface, 21 to 35 (18) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; process strongly reduced in some specimens; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4), pharyngobranchial 3 with triangular laminar expansion on posterior margin; triangular laminar expansion with notches in some specimens; two triangular expansions in some specimens. Upper tooth plate oval; 25 to 46 (18) teeth generally aligned in two rows on posteroventral surface; aligned in three rows in some specimens.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch conspicuously reduced, with single pore opening close to postotic main canal; more developed, with pore opening closer to anteroventral border of compound pterotic in some specimens;

postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel; slightly shorter; pore opening closer to supraorbital main canal in some specimens. Nasal canal generally with three openings, first on posterior edge, second on posterolateral portion and third on anterior edge; second pore generally fused with first pore; second opening absent in some specimens. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and generally opening into two pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula in some specimens.

Dorsal fin somewhat triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,6 (1), II,8 (62), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly to moderately developed in length; posterior portion exposed and with minute odontodes; anterior tip covered by thick layer of skin; almost entirely exposed in some specimens (Fig. 62); spinelet short; partially exposed; spine ranging from poorly developed, with adpressed distal tip reaching to middle portion of dorsal-fin base, to relatively well developed, with adpressed distal tip slightly surpassing posterior origin of dorsal-fin base; anterior margin with small odontodes. Pectoral fin roughly triangular, its origin just posterior to gill opening. Pectoral-fin rays I,8 (18), I,9 (42), I,10 (3); posterior margin of pectoral spine with 12 to 29 poorly- to well-developed serrations along almost its entire length; small region just posterior to origin of spine lacking serrations; some serrations directed towards origin of spine, perpendicularly directed or directed towards tip of spine; presence of bifid serrations in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 63). Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below third or fourth ventrolateral body plate, and at vertical through second or third dorsal-fin branched ray. Pelvic-fin rays i,5 (62), i,6 (1). Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by seven to eight dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 12th, 13th or 14th ventrolateral body plates, and at vertical

through region of preadipose platelets or origin of adipose spine. Anal-fin rays ii,4,i (2), ii,5,i (27), ii,6 (34). Caudal-fin rays i,11,i (1), i,12,i (61), i,13,i (1), four to six dorsal and/or ventral procurrent rays; bilobed, lobes with similar size; dorsal lobe slightly larger than ventral lobe in some specimens.

Two to four laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third and fourth lateral-line canals, if present, encased in third and fourth dorsolateral body plates, respectively. Body plates with conspicuous line of relatively large odontodes confined on posterior margins; dorsolateral body plates 24 (4), 25 (33), 26 (24), 27 (2); ventrolateral body plates 21 (3), 22 (27), 23 (29), 24 (4); dorsolateral body plates along dorsal-fin base 5 (1), 6 (51), 7 (11); dorsolateral body plates between adipose-fin spine and caudal-fin base 7 (6), 8 (35), 9 (22); preadipose platelets 2 (4), 3 (21), 4 (34), 5 (4); 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. Anterior margin of orbit, above region of junction of frontal with lateral ethmoid, generally with small platelets. Ventrolateral portion of snout, region of nasal capsule and dorsal portion of snout, above mesethmoid, with small platelets in some specimens; ventrolateral portion of snout with relatively large platelets in some specimens (Fig. 61). Region between nuchal plate and posterior process of parieto-supraoccipital with small- to medium-sized platelets in some specimens (Fig. 62c). Ventral surface of trunk covered by small irregular platelets, generally more concentrated on its anterior portion; platelets densely disposed in some specimens.

Vertebral count 23 (5). 24 (13), 25 (1); ribs 6 (14), 7 (5) first pair conspicuously large; parapophysis of complex vertebra generally moderately developed; single specimen with well developed in the right side of the body (UFPB 9418, CS, 23.0 mm SL).

Coloration in alcohol. Color pattern highly variable. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores; with relatively large rounded or irregular black blotches on top of head in some specimens. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores densely disposed in some specimens; forming dark brown or black rounded, striated or irregular small to relatively large spots in some specimens; spots diffuse in some specimens; generally, with dark brown or black diffuse or conspicuous stripe from anteroventral portion of eye to upper lip lateral area;

ventrolateral portion of snout with dark brown or black chromatophores in some specimens. Upper lip and maxillary barbel with dark brown or black chromatophores; area of lateral portion of upper lip with conspicuous concentration of dark brown or black chromatophores in some specimens; outer mental barbel generally lacking chromatophores. Dorsal series of four to six dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third, if present, between dorsal and adipose fins, fourth on adipose-fin base, fifth, if present, on middle portion of caudal peduncle, and sixth on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with conspicuous concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk and region posterior to urogenital opening generally lacking chromatophores. First dorsolateral body plate with conspicuous concentration of dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and lateral line pores with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank generally with longitudinal series of four to six small- to large-sized conspicuous dark brown or black blotches; blotches rounded, oblong or irregular; blotches diffuse or fused with each other in some specimens, forming longitudinal stripe. Dorsal half of dorsolateral body plates with dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base, between dorsal and adipose fins, adipose-fin base, and base of caudal peduncle generally with more concentrated chromatophores, forming conspicuous blotches in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident on anterior portion of body and on area of flank midline blotches. Mid-ventral portion and ventral half of ventrolateral body plates generally with scarce dark brown or black chromatophores; almost entirely lacking chromatophores in some specimens; or mid-ventral portion of ventrolateral body plates on area of flank midline blotches with concentration of dark brown or black chromatophores, forming conspicuous blotches in some specimens; blotches generally more evident posteriorly to pelvic-fin origin; ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident posterior to anal-fin anterior origin, in some specimens. Dorsal fin generally lacking small spots, with conspicuous concentration of dark brown or black chromatophores on its middle portion, forming conspicuous, large to extremely large and intensely pigmented black blotch; blotch gradually becoming faded posteriorly in some specimens; area with concentration of dark brown or black chromatophores extending towards anterior portion of dorsal-fin base and/or

towards distal margin of dorsal-fin in some specimens; remaining portions of dorsal fin generally with non-intensely pigmented chromatophores; blotch obliquely fragmented, forming two smaller blotches in some specimens; blotch(es) less pigmented in some specimens; region of blotch(es) with almost entirely hyaline membranes in some specimens, forming series of dark brown or black spots; presence of non-aligned dark brown or black small spots in some specimens; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; covered by dark brown or black spots in some specimens; spots generally diffuse and more evident on first branched rays; almost entirely hyaline in some specimens; region of body around dorsal portion of pectoral-fin origin with concentration of dark brown or black chromatophores in some specimens. Pelvic fin generally entirely or almost entirely hyaline; with dark brown or black chromatophores on its dorsal surface in some specimens. Adipose-fin membrane with dark brown or black chromatophores; generally, with conspicuous concentration of dark brown or black chromatophores in some areas of membrane, generally more evident close to spine, forming isolated patches in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal fin with conspicuous concentrations of dark brown or black chromatophores in some areas, generally more evident on its middle portion and bases of last branched rays; with one or two dark brown or black blotches in some specimens; or hyaline. Middle portion of caudal-fin base, posteriorly to last flank midline blotch, generally with small- to medium-sized dark brown or black blotch; blotch diffuse or fused with last midlateral blotch in some specimens. Caudal fin with three to six transversal dark brown or black slender to thick bars.

Coloration in life. Similar to that observed in preserved specimens but with ground color of body grayish yellow in some specimens. Body covered by whitish yellow and green iridescent coloration (Fig. 64).

Geographical distribution. *Aspidoras raimundi* is known from the rio Parnaíba basin in Ceará, Maranhão and Piauí states, rio São Francisco basin in Pernambuco State, rio Tocantins basin in Tocantins State, and from the rivers Acaraú, Coreaú and Jaguaribe basins in Ceará State (Fig. 9b).

Remarks. After the analysis of high resolution photographs of the lectotype (NMW 61110) and paralectotypes (NMW 46792, 46794 and 46795), it was possible to observe at least four conspicuously variable features within *A. raimundi* type series: (I) the general morphology of snout, which ranged from short and rounded to moderately developed and pointed, (II) the size and intensity of pigmentation of the dorsal-fin blotch, ranging from large to extremely large and slightly faded to strongly pigmented, (III) the flank midline blotches, that ranged from small to moderate in size and from roundish or irregular to longitudinally elongated, and (IV) the ventral laminar expansion of infraorbital 2, ranging from moderately to strongly well-developed (Fig. 61). Additionally, it was possible to observe the presence of a single juvenile specimen of *Corydoras* among the paralectotypes under voucher NMW 46795 (Fig. 65), which must be properly identified and placed under a new voucher.

The analysis of non-type specimens from the Parnaíba River basin also revealed a similar degree of variation but with a slightly larger range of variation regarding color pattern, allowing the recognition of four morphotypes. Despite most specimens from the Parnaíba River basin present a very similar color pattern to the type specimens (e. g. UFPB 8159, UFPB 9936, UFPB 11012, UFPB 11013, UFPB 11016, UFRN 3085 and UFRN 3346), some specimens presented absence of conspicuous flank midline blotches (UFPB 9934, in two of the eight examined; see Fig. 66a), some specimens with flank midline blotches fused with each other, forming larger longitudinally elongated blotches and/or stripe (UFPB 7072, in five of the seven examined, UFPB 9418, in 42 of the 43 examined, UFPB 9933, in three of the five examined, and in the single specimen of UFPB 11014; see Fig. 66b), and even flank midline blotches fused with each other, forming larger longitudinally elongated blotches and/or stripe plus dorsal-fin blotch clearly less pigmented and/or fragmented, or absent in some specimens (UFPB 9933, in two of the five examined, UFPB 9415, in 64 of the 67 examined, and in the two specimens of UFPB 11015; see Fig. 66c).

According to Nijssen & Isbrücker (1976: 124), the color pattern of *Aspidoras spilotos* (Fig. 67) is characterized by “Body with prominent dark brown, oval spots along the meeting of dorso- and ventrolateral body scutes. There are four more or less isolated spots in one paratype. In the other specimens the spots are united, sometimes forming a single longitudinal bar from cleithrum to base of caudal fin. Most of the specimens are intermediate between these two patterns.” and “Dorsal fin with small, dark brown spots, mostly in the upper half of the fin, sometimes forming one or two narrow horizontal or slightly oblique lines, irregularly arranged in other specimens, sometimes forming a small triangular blotch.”, which was also observed in several *A. raimundi* specimens. The analysis of photographs of the holotype and two paratypes

(ZMA 112.284 and USNM 213568; see Fig. 66d), and non-type specimens from the Acaraú River basin, type locality of *A. spilotus*, revealed that the general morphological pattern, including infraorbitals, pectoral-fin spine serrations and distance between nuchal plate and posterior tip of parieto-supraoccipital process, also falls within the range observed in *A. raimundi* populations. Therefore, since no conspicuous diagnostic features were found, we propose the synonymization of *A. spilotus* under *A. raimundi*. Additionally, specimens from the Coreaú River basin, Ceará State, also presented similar color and morphological patterns, with exception of the relatively large size of some specimens (UFPB 9247, with up to 39.3 mm SL; see Fig. 66e), and are also considered as a morphotype of *A. raimundi*.

The analysis of specimens from the Jaguaribe River basin, Ceará State, from where *A. menezesi* (Fig. 68) was described, also revealed that most of them presents similar color and morphological patterns to the observed in *A. raimundi* type specimens. However, some specimens present the variable dorsal-fin color patterns described by Nijssen & Isbrücker (1976: 124) for *A. spilotus*, which are also present in some *A. raimundi* specimens examined herein. Despite Nijssen & Isbrücker (1976: 121) did not mention the presence of a large blotch on dorsal fin, the analysis of photographs of the holotype showed that, although its irregular shape, a large dark brown or black blotch is present (Fig. 68). Considering the examined material, most specimens present the dorsal-fin pattern similar to the observed in typical *A. raimundi*, with only few specimens (MCP 47296, 3 of 14; MCP 47283, 1 of 15; and UFRN 1241, 3 of 3; see Fig. 66f) presenting the aforementioned variable forms found in *A. raimundi* populations. The frequency of the typical dorsal-fin color pattern was not counted in lots MZUSP 24634 and MZUSP 53430.

Regarding the series of blotches along midline of flank, Nijssen & Isbrücker (1976: 120) mentioned that *A. menezesi* presents “Color pattern on sides of body variable, consisting of medium-sized to rather large irregular dark brown blotches, most prominent along midlateral longitudinal body scutes, posteriorly sometimes united to form one elongate horizontal blotch.”, and therefore also overlapping with *A. raimundi* (see Fig. 66). Similar to what was observed in specimens previously attributed to *A. spilotus* from the Coreaú River basin, the most different specimens in relation to *A. raimundi* are the unusually large ones (UFRN 1241, with up to 41.1 mm SL; see Fig. 66f), which is the case of *A. menezesi* holotype (41.8 mm SL) and may have led Nijssen & Isbrücker (1976) to consider it as new. However, as the case of the populations from the rivers Acaraú and Coreaú basins, both previously recognized as *A. spilotus*, the most useful features to diagnose *Aspidoras* species (i.e. infraorbital 1, frontal and complex vertebra morphology and details in color pattern) were examined in several specimens matching *A.*

menezesi description, and also fell within *A. raimundi* range. Considering this, the most reasonable choice is to consider *A. menezesi* as a junior-synonym of *A. raimundi*.

Additionally, a single specimen collected in a tributary to the São Francisco River basin in Pernambuco State (UFPB 7140; see Fig. 66g) and several specimens from the Tocantins River basin in Maranhão and Tocantins states (see Fig. 66h), strongly reassembles *A. raimundi* in morphological and color patterns (Fig. 66), presenting overlaps in all potential diagnostic features raised in this study, and, by this reason, will also be considered as populations of it.

Material examined. In addition to the material examined by Nijssen & Isbrücker (1976: 120, 123), the following material was analysed. All from Brazil. MCP 47280, 2, 22.2–23.5 mm SL, Ceará State, rio Salgado, rio Jaguaribe basin. MCP 47283, 15 of 18, 21.3–27.7 mm SL, 1 CS, 27.3 mm SL, Ceará State, rio Batateiras, rio Jaguaribe basin. MCP 47284, 19 of 30, 19.5–28.4 mm SL, 1 CS of 30, 25.2 mm SL, Ceará State, rio Batateiras, rio Jaguaribe basin. MCP 47294, 7, 20.0–23.0 mm SL, Ceará State, rio Batateiras, rio Jaguaribe basin. MCP 47296, 14 of 20, 22.1–29.2 mm SL, 1 CS of 20, 27.5 mm SL, Ceará State, rio Salgado, rio Jaguaribe basin. MCP 47303, 9 of 16, 23.2–28.8 mm SL, 1 CS of 16, 28.4 mm SL, Ceará State, rio Batateiras, rio Jaguaribe basin. MCP 47304, 9 of 17, 21.3–29.7 mm SL, 1 CS of 17, 28.3 mm SL, Ceará State, rio Batateiras, rio Jaguaribe basin. MNRJ 42399, 1, 28.1 mm SL, Ceará State, rio Salamanca, rio Jaguaribe basin. MNRJ 42401, 9, 19.8–31.8 mm SL, Tocantins State, córrego Suçuarana, rio Tocantins basin. MNRJ 47929, 1, 30.0 mm SL, Ceará State, rio Jaguaribe, rio Jaguaribe basin. MNRJ 49844, 59, 13.5–28.4 mm SL, Maranhão State, unnamed stream, rio Tocantins basin. MZUSP 24634, 29, 15.4–37.2 mm SL, Ceará State, córrego Água Suja, rio Jaguaribe basin. MZUSP 53430, 15, 17.3–39.4 mm SL, Ceará State, córrego Água Suja, rio Jaguaribe basin. MZUSP 110755, 7, 20.9–43.1 mm SL, Ceará State, weir in the rio Acaraú, rio Acaraú basin. MZUSP 110778, 1, 27.8 mm SL, Ceará State, rio Acaraú, rio Acaraú basin. UFPB 7064, 20, 9.4–25.1 mm SL, Ceará State, rio Acaraú, rio Acaraú basin. UFPB 7072, 7 of 8, 19.9–25.3 mm SL, Piauí State, rio São Nicolau, rio Parnaíba basin. UFPB 7140, 1, 22.2 mm SL, Pernambuco State, córrego São Pedro, rio São Francisco basin. UFPB 7616, 6, 18.2–19.9 mm SL, Ceará State, rio Groaíras, rio Acaraú basin. UFPB 8159, 1, 25.6 mm SL, Piauí State, rio Parnaíba, rio Parnaíba basin. UFPB 9247, 3 of 7, 34.3–39.3 mm SL, 2 CS of 7, 27.4–30.5 mm SL, Ceará State, rio das Minas, rio Coreaú basin. UFPB 9251, 4, 22.2–27.2 mm SL, Ceará State, rio Ubajara, rio Coreaú basin. UFPB 9415, 67 of 176, 16.9–26.6 mm SL, 2 CS of 176, 23.9–24.2 mm SL, Ceará State, rio Piau, rio Parnaíba basin. UFPB 9418, 43 of 51, 16.0–24.2 mm SL, 2 CS of 51, 21.0–23.0 mm SL, Piauí State, stream under the bridge on the road between

São Miguel da Baixa Grande–São Félix do Piauí, rio Parnaíba basin. UFPB 9427, 1, 24.4 mm SL, Ceará State, rio Cascata, rio Jaguaribe basin. UFPB 9933, 5 of 6, 18.9–23.1 mm SL, Ceará State, rio Jaburu, rio Parnaíba basin. UFPB 9934, 7 of 9, 22.0–25.8 mm SL, 1 CS of 9, 22.4 mm SL, Maranhão State, córrego Alagado, rio Parnaíba basin. UFPB 9936, 2, 19.2–19.5 mm SL, Piauí State, rio Gurgueia, rio Parnaíba basin. UFPB 11012, 5 of 6, 15.2–24.3 mm SL, Piauí State, rio Gurgueia, rio Parnaíba basin. UFPB 11013, 6 of 7, 14.5–19.2 mm SL, Piauí State, córrego Bonfim, rio Parnaíba basin. UFPB 11014, 1, 22.3 mm SL, Piauí State, rio Sambito, rio Parnaíba basin. UFPB 11015, 2, 21.2–22.0 mm SL, Ceará State, rio Arabé, rio Parnaíba basin. UFPB 11016, 10 of 12, 12.2–19.0 mm SL, 1 CS of 12, 21.2 mm SL, Maranhão State, rio Parnaíba, rio Parnaíba basin. UFRN 1241, 3, 34.1–41.1 mm SL, Ceará State, córrego da Cascata, rio Jaguaribe basin. UFRN 1466, 3, 20.5–31.5 mm SL, Ceará State, córrego Gavião, rio Coreau basin. UFRN 2662, 10, 19.4–25.4 mm SL, Ceará State, córrego Gavião, rio Coreau basin. UFRN 2895, 1, 23.1 mm SL, Ceará State, córrego Ipuçaba, rio Acaraú basin. UFRN 3085, 9, 13.7–23.5 mm SL, Maranhão State, rio Parnaíba, rio Parnaíba basin. UFRN 3346, 20 of 43, 16.1–23.0 mm SL, Piauí State, rio Gurgueia, rio Parnaíba basin. UFRN 3735, 16, 19.7–27.5 mm SL, Ceará State, córrego Ipuçaba, rio Acaraú basin. UFRN 3745, 12, 22.3–29.8 mm SL, Ceará State, córrego Ipuçaba, rio Acaraú basin. UNT 539, 5 of 6, 24.7–27.6 mm SL, 1 CS of 6, 25.1 mm SL, Tocantins State, stream crossing the road BR 153 between Filadélfia and Araguaína, 79 km from Araguaína, rio Tocantins basin. UNT 7833, 3, 18.0–20.3 mm SL, Tocantins State, rio Palmas, rio Tocantins basin. UNT 10106, 11 of 13, 20.4–36.0 mm SL, 2 CS of 13, 25.9–28.3 mm SL, Tocantins State, stream tributary to the rio Manuel Alves, rio Tocantins basin. UNT 10135, 7 of 8, 18.8–28.5 mm SL, 1 CS of 8, 23.7 mm SL, Tocantins State, stream tributary to the rio Manuel Alves, rio Tocantins basin. UNT 10136, 2, 18.3–20.2 mm SL, Tocantins State, stream tributary to the rio Manuel Alves, rio Tocantins basin. UNT 12295, 6 of 7, 18.5–32.0 mm SL, 1 CS of 7, 28.4 mm SL, Tocantins State, isolated ponds at Boa Fé Farm, rio Tocantins basin. UNT 12305, 10 of 11, 18.7–34.0 mm SL, 1 CS of 11, 23.3 mm SL, Tocantins State, córrego Cana Brava, rio Tocantins basin. UNT 14451, 1, 28.6 mm SL, Tocantins State, rio Manuel Alves, rio Tocantins basin. UNT 14452, 5, 21.0–28.5 mm SL, Tocantins State, rio Manuel Alves, rio Tocantins basin. UNT 14465, 3, 23.1–30.6 mm SL, Tocantins State, rio Gameleira, rio Tocantins basin. UNT 14557, 3, 18.8–20.4 mm SL, Tocantins State, rio Arraias, rio Tocantins basin.

***Aspidoras rochai* Ihering, 1907**

(Fig. 69)

Aspidoras rochai Ihering, 1907: 30–35 (original description; type locality: Fortaleza, Ceará State, Brazil). –Britski, 1969: 206 (brief description; designation of the lectotype). –Menezes, 1994: 220 (correction of the type locality to Guaramiranga, Ceará, Brazil). –Nijssen & Isbrücker, 1976: 110–111 (identification key; redescription). –Britto, 2000: 1054 (listed as comparative material; *partim*). –Lima & Britto, 2001: 1015 (listed as comparative material; *partim*). –Reis, 2003: 292 (listed). –Ferraris, 2007: 110 (listed). –Wosiacki *et al.*, 2014: 311, 315 (morphological comparison; listed as comparative material). –Oliveira *et al.*, 2017: e160118[3], e160118[7] (morphological comparison; listed as comparative material). –Tencatt & Bichuette, 2017: 8–9, 21 (morphological comparison; listed as comparative material).

Diagnosis. *Aspidoras rochai* can be distinguished from all of its congeners by having the following color pattern: a light and somewhat irregular band on middle portion of the dorsolateral body plates, which runs parallel to flank midline from the region just anterior to dorsal fin to the caudal peduncle, being united with the stripe of the other side of the body in the predorsal region (*vs.* absence). Additionally, it can be distinguished from *A. depinnai*, *A. poecilus*, *A. psammatides*, *A. raimundi*, *A. velites* and *Aspidoras* sp. by having relatively wide frontal bone, with width equal to or slightly larger than half of entire length (*vs.* narrow, with width slightly smaller than half of entire length in *A. depinnai*, *A. poecilus*, *A. raimundi*, *A. velites* and *Aspidoras* sp.; strongly narrow, with width conspicuously smaller than half of entire length in *A. psammatides*).

Remarks. According to Ihering (1907: 34), *Aspidoras rochai*, the type species of the genus, was described based on two specimens from Fortaleza, the capital of Ceará State, Brazil. Despite that, Menezes (1994: 220) mentioned that Francisco Dias da Rocha, the collector of both type specimens, informed that, in fact, these specimens were captured in Guaramiranga, also in Ceará State, and not in Fortaleza. The region of Guaramiranga is drained by tributaries to the Aracoiaba River, itself a tributary to the Choró River, which quite possibly is the drainage from where these species were captured, though no water body was mentioned by Menezes (1994). Therefore, based on Menezes's (1994) statement, the type locality of *Aspidoras rochai* is herein corrected to Guaramiranga, Ceará State, Brazil. Although, it was possible to analyse both type specimens of *A. rochai*, no additional specimens matching them were found. Since the core of the Corydoradinae taxonomy rests in osteology plus color pattern, it was not possible to gather significative additional information from the two old and damaged type specimens

when compared to the first review by Nijssen & Isbrücker (1976), and therefore, no redescription of *A. rochai* could be provided herein.

In spite of the limited information obtained from both type specimens, it was possible to differ *A. rochai* from its congeners, with the exception of *A. albater*, *A. fuscoguttatus*, *A. mephisto* and *A. lakoi*, by having a relatively wide frontal bone, with width equal to or slightly larger than half of entire length (*vs.* strongly narrow, with width conspicuously smaller than half of entire length, in *A. psammatides*; narrow, with width slightly smaller than half of entire length, in remaining congeners). *Aspidoras rochai* differs from *A. albater*, *A. mephisto* and *A. lakoi* by having anterior portion of infraorbital 1 with well-developed expansion, surpassing middle of nasal capsule (*vs.* with expansion ranging from strongly reduced, at same level as posterior margin of nasal capsule, to moderately-developed expansion, reaching to middle of nasal capsule in *A. albater*; with expansion ranging from strongly reduced, not reaching to or at same level as posterior margin of nasal capsule, to moderately-developed expansion, reaching to middle of nasal capsule in *A. mephisto*; with expansion ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. lakoi*).

Although *A. fuscoguttatus* is the most similar congener to *A. rochai*, considering only the few external osteological information observed herein, it was possible to differ both species based on the unusual color pattern of *A. rochai*, described by Ihering (1907: 32), which is characterized by the presence of a light and somewhat irregular band on middle portion of the dorsolateral body plates, running parallel to the “lateral line” (presumably the flank midline) from the region just anterior to dorsal fin to the caudal peduncle, being united with the stripe of the other side of the body in the predorsal region. Ihering (1907: 33) also published a Portuguese version of this description, curiously with small differences from the English version, such as the presence of a light blotch on the region where the stripes from both sides of the body are fused. Additionally, the author also indirectly refers to the presence of what seems to be a “lower stripe” in the Portuguese version, comparing its intensity of pigmentation in relation to the stripe slightly above midline of flank. Ihering (1907) made no further reference to this “lower stripe”. Anyway, the aforementioned pattern is not present in *A. fuscoguttatus*.

***Aspidoras velites* Britto, Lima & Moreira, 2002**

(Fig. 70)

Aspidoras velites Britto, Lima & Moreira, 2002:727–736 (original description; type-locality: Boiadeiro Stream, Mato Grosso State, Brazil). –Britto *et al.*, 2005: 477 (morphological

comparison). –Ferraris, 2007: 110 (listed). –Wosiacki *et al.*, 2014: 311 (morphological comparison). –Leão *et al.*, 2015: 578 (morphological comparison). –Tencatt & Bichuette, 2017: 8 (morphological comparison).

Diagnosis. *Aspidoras velites* can be distinguished from all of its congeners by the presence of the following features: absence of dorsal-fin spinelet (*vs.* presence), parieto-supraoccipital fontanel located close to origin of posterior process (*vs.* located mesially or slightly displaced towards posterior portion of parieto-supraoccipital in *A. albater*; slightly displaced towards anterior portion of parieto-supraoccipital in *A. lakoi*; located mesially on parieto-supraoccipital in remaining congeners), and ventral surface of trunk covered by striated platelets (*vs.* platelets, when present, non-striated). Additionally, *A. velites* can be distinguished from its congeners, except for *A. albater*, *A. mephisto* and *A. psammatides*, by having anterior portion of infraorbital 1 with strongly reduced expansion, not reaching to or at same level as posterior margin of nasal capsule (*vs.* extremely well developed, reaching to or surpassing anterior margin of nasal capsule in *A. belenos*; well developed, surpassing middle of nasal capsule in *A. depinnai*, *A. maculosus* and *A. rochai*; ranging from well developed, surpassing middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule in *A. fuscoguttatus*; ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to moderately developed, reaching to middle of nasal capsule in *A. lakoi* and *Aspidoras* sp.; ranging from poorly developed, slightly surpassing posterior margin of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule in *A. poecilus*; ranging from moderately developed, reaching to middle of nasal capsule, to extremely well developed, reaching to anterior margin of nasal capsule in *A. raimundi*); it can be distinguished from *A. albater* and *A. mephisto* plus *A. lakoi* and *A. rochai* by the presence of a narrow frontal bone, with width smaller than half of entire length (*vs.* relatively wide, with width equal to or slightly larger than half of entire length); from *A. psammatides* by the color pattern of the flank midline (relatively thick longitudinal dark brown or black stripe *vs.* longitudinal series of five to ten small- to medium-sized conspicuous dark brown or black blotches)

Description. Morphometric data in Britto *et al.* (2002). Head slightly compressed with convex dorsal profile; somewhat trapezoid in dorsal view. Snout large and conspicuously pointed. Head profile convex from tip of snout to anterior nares; ascending nearly straight from this point to tip of posterior process of parieto-supraoccipital. Region between the tip of posterior process

of parieto-supraoccipital and nuchal plate nearly straight; smoothly concave in some specimens. Profile nearly straight along dorsal-fin base; smoothly convex in some specimens. Postdorsal-fin body profile nearly straight to adipose-fin spine; smoothly concave from this point to caudal-fin base. Ventral profile of body slightly convex from isthmus to pelvic-fin origin; region of gill opening slightly concave in some specimens; nearly straight from this point to anal-fin origin; smoothly concave until caudal-fin base. Body acutely elliptical in cross section at pectoral girdle, smoothly becoming more compressed toward caudal fin.

Eye rounded, located dorso-laterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares relatively distant to each other, separated by distance equal to twice of naris diameter. Anterior naris tubular. Posterior naris relatively distant to anterodorsal margin of orbit, separated from it by distance equal to twice of naris diameter. Mouth small, subterminal, width slightly larger than bony orbit diameter. Maxillary barbel moderate in size, not reaching anteroventral limit of gill opening. Outer mental barbel slightly larger than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Lower lip well developed, forming relatively large triangular fleshy flap. Small rounded papillae covering entire surface of all barbels, upper and lower lips, snout and isthmus.

Mesethmoid short; anterior tip well developed, larger than 50% of bone length (see Britto, 2003: 123, character 1, state 0; fig. 1A); posterior portion wide, partially exposed. Nasal slender, smoothly curved laterally, inner margin with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border contacting frontal and mesethmoid.

Frontal elongated, narrow, with width smaller than half of entire length (see Fig. 3a); anterior projection short, size smaller than nasal length. Frontal fontanel relatively small, ellipsoid or somewhat rhomboid; posterior tip extension not entering anterior margin of parieto-supraoccipital. Sphenotic somewhat trapezoid, contacting parieto-supraoccipital dorsally, compound pterotic posteriorly, second infraorbital ventrally and frontal anteriorly. Compound pterotic roughly pipe-shaped, with posteriormost portion contacting first lateral-line ossicle, and ventral margin contacting opercle and cleithrum; posterior expansion almost entirely covering lateral opening of swimbladder capsule, leaving slender pseudotympanic area on its dorsal margin covered only by thick layer of skin. Parieto-supraoccipital moderate in size, posterior process strongly reduced, not contacting nuchal plate. Parieto-supraoccipital medial keel expanded ventrally; laminar, with posterior portion expanded posteriorly, surpassing tip of

posterior process. Parieto-supraoccipital fontanel small, ellipsoid; located close to origin of posterior process.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion very reduced; anterior portion with strongly reduced laminar expansion, not reaching to or at same level as posterior margin of nasal capsule (Fig. 71); inner laminar expansion poorly developed (see Fig. 5d); small portions of external surface covered by thick layer of skin; infraorbital 2 small, slender; with posterior laminar expansion strongly reduced; posteroventral margin not in contact with posterodorsal ridge of hyomandibula, dorsal tip contacting only sphenotic; small portions of external surface covered by thick layer of skin (Fig. 71). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, slender; exposed areas generally bearing small odontodes. Interopercle generally entirely covered by thick layer of skin; somewhat triangular, anterior projection well-developed. Preopercle slender, elongated, minute odontodes sparse on external surface. Opercle slightly more elongated dorso-ventrally, width nearly equal to half of its length; free margin smoothly convex; posterodorsal region with smoothly concave area in some specimens; without serrations and covered by small odontodes; some portions of bony distal margin irregular in some specimens.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion moderately developed, size similar to cartilaginous portion; or poorly developed, size smaller than cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 with small process on anterior margin of mesial portion; ceratobranchial 3 with continuous postero-lateral margin; variably notched; ceratobranchial 5 toothed on postero-dorsal surface, 16 to 19 (3) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, variably with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two pharyngobranchials (3 and 4); pharyngobranchial 3 wide, with triangular laminar expansion on posterior margin; expansion with notch in some specimens; pharyngobranchial 4 reduced. Upper tooth plate oval; 19 to 27 (3) teeth aligned in two rows on postero-ventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculomandibular branch

conspicuously reduced, with single pore opening close to postotic main canal; postotic main canal becoming widened just posterior to pterotic branch. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, other branch entering frontal through supraorbital canal, both with single pore. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal relatively long; pore opening close to frontal fontanel. Nasal canal with two to three openings, first on posterior edge, second, if present, on posterolateral portion, generally fused with first pore, and third on anterior edge. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which generally runs through posterodorsal ridge of hyomandibula and entire preopercle with three openings, leading to pores 3, 4, and 5, respectively; pore 3 opening at posterodorsal ridge of hyomandibula.

Dorsal fin somewhat triangular, located just posterior to third or fourth dorsolateral body plate. Dorsal-fin rays I,8* (59), posterior margin of dorsal-fin spine smooth. Nuchal plate poorly developed in length; strongly reduced in some specimens; covered by thick layer of skin (Fig. 72); spinelet absent (Fig. 72a); single specimen (MZUSP 73264, 20.5 mm SL, paratype) with strongly reduced and irregular bony plate added to dorsal-fin spine basis, possibly reminiscent of first dorsal-fin element (Fig. 72b); spine poorly developed, adpressed distal tip slightly surpassing middle portion of dorsal-fin base; anterior margin with small odontodes. Pectoral fin oblong, its origin just posterior to gill opening. Pectoral-fin rays I,7 (29), I,8* (29), I,9 (4); posterior margin of pectoral spine with two to six very reduced serrations; serrations generally perpendicularly directed; some serrations slightly directed towards tip or origin of spine in some specimens; base of branched rays with small laminar expansions on its inner margin, generally more evident on first rays; laminar expansions with irregular margins in some specimens (Fig. 73); Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid reduced, externally visible. Pelvic fin oblong, located just below fourth ventrolateral body plate, and at vertical through second dorsal-fin branched ray. Pelvic-fin rays i,5. Adipose fin roughly triangular, separated from posterior origin of dorsal-fin base by generally eight dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 13th, 14th or 15th ventrolateral body plates, and at vertical through region of preadipose platelets. Anal-fin rays ii,6* (54), ii,7 (8). Caudal-fin rays i,12,i (22), generally four dorsal and/or ventral procurrent rays; bilobed, lobes with similar size.

Three or four laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third and fourth lateral-line canals, if present, encased in third and fourth dorsolateral body plates, respectively. Body plates with conspicuous line of relatively well-developed odontodes confined on posterior margins; dorsolateral body plates 25 (2), 26 (16), 27* (33), 28 (11); ventrolateral body plates 24* (21), 25 (19), 26 (9); dorsolateral body plates along dorsal-fin base 4 (10), 5* (47), 6 (5); dorsolateral body plates between adipose-fin spine and caudal-fin base 8 (9), 9* (43), 10 (10); preadipose platelets 1 (2), 2 (11), 3 (8), 4 (1); 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. Ventral surface of trunk covered by striated platelets; posterior portion of isthmus generally with platelets (see Tencatt & Bichuette, 2017: 8, fig. 6b).

Vertebral count 25 (3); ribs 5 (2), 6 (1) first pair conspicuously large; parapophysis of complex vertebra moderately developed.

Coloration in alcohol. Ground color of body light or brownish yellow, with top of head dark brown. Posterodorsal portion of head, region below eye, opercle and cleithrum with scattered dark brown or black chromatophores. Snout covered by dark brown or black chromatophores on its dorsal surface; chromatophores generally more concentrated on region of nasal bone and posterior portion of mesethmoid; with conspicuous dark brown or black stripe from anteroventral portion of eye to upper lip lateral area. Upper lip and maxillary barbel with dark brown or black chromatophores; outer mental barbel covered by dark brown or black chromatophores, generally more concentrated on its proximal portion. Dorsal series of three to five dark brown or black blotches, first on anterior portion of dorsal-fin base, second on posterior portion of dorsal-fin base, third on adipose-fin base, fourth, if present, middle portion of caudal peduncle, and fifth, if present, on caudal-fin base; blotches diffuse in some specimens. Dorsal portion of body with concentration of dark brown or black chromatophores between counterparts of dorsolateral body plates in some specimens. Ventral surface of trunk and region posterior to urogenital opening lacking dark brown or black chromatophores; region posterior to urogenital opening with dark brown or black chromatophores in some specimens. First dorsolateral body plate almost entirely covered by dark brown or black chromatophores; posterior margin of some dorso- and ventrolateral plates, and region of lateral line canals with conspicuous concentration of dark brown or black chromatophores in some specimens. Midline of flank with relatively thick longitudinal dark brown or black stripe. Dorsal portion of

dorsolateral body plates with conspicuous concentration of dark brown or black chromatophores; region of anterior and posterior portions of dorsal-fin base and adipose-fin base with slightly more concentrated chromatophores in some specimens. Ventral half of dorsolateral body plates and dorsal half of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident on anterior portion of body, in some specimens. Ventral portion of ventrolateral body plates with concentration of dark brown or black chromatophores, generally more evident from region posterior to pelvic-fin origin to region just posterior to anal-fin posterior origin; generally forming longitudinal slender black stripe; stripe diffuse or fragmented in some specimens. Dorsal fin with dark brown or black chromatophores, generally restricted to rays; chromatophores generally more concentrated on proximal half of rays; dorsal-fin base with conspicuous concentration of dark brown or black chromatophores, generally more concentrated on bases of first and last branched rays; spine covered by dark brown or black chromatophores, generally more evident on its distal portion. Pectoral fin with dark brown or black chromatophores on its dorsal surface, generally more evident on spine and first branched rays; or almost entirely hyaline; region of body around dorsal portion of pectoral-fin origin with concentration of dark brown or black chromatophores in some specimens. Pelvic generally covered by dark brown or black chromatophores on its dorsal surface; almost entirely hyaline in some specimens; chromatophores generally restricted to rays; region of body around dorsal portion of pelvic-fin origin with concentration of dark brown or black chromatophores in some specimens. Adipose-fin membrane with dark brown or black chromatophores, generally more evident close to spine; almost entirely hyaline in some specimens; adipose-fin spine generally with dark brown or black chromatophores. Anal with dark brown or black chromatophores, generally restricted to rays; chromatophores more concentrated on proximal half of branched rays; with one or two dark brown or black diffuse blotches in some specimens. Middle portion of caudal-fin base, posteriorly flank midline stripe, generally with medium-sized dark brown or black blotch and fused with stripe; diffuse in some specimens. Caudal fin with dark brown or black chromatophores, generally more evident on rays; forming one to four transversal dark brown or black relatively thick bars in some specimens.

Coloration in life. As mentioned by Britto *et al.* (2002): “Based on transparencies from one specimen (MZUSP 73247, 27.9 mm SL). Ground color grayish. Reddish-brown pigmentation on dorsal surface of head and caudal-fin base. Stripes grayish-brown. Bright gold on sides of

head and anterior portion of trunk. Two approximately symmetrical light roundish blotches present on upper and lower caudal-fin base.” (Fig. 74).

Geographical distribution. *Aspidoras velites* is known only from the upper portion of the rio Araguaia basin, in the regions of Alto Araguaia Municipality, Mato Grosso State, and of Santa Rita do Araguaia Municipality, Goiás State (Fig. 9b).

Remarks. *Aspidoras velites* presents some peculiar and apparently exclusive features, besides its general morphological pattern, which makes it the most peculiar species within Corydoradinae. One of the possible exclusive features is the presence of clearly larger and striated platelets on ventral surface of the trunk (see Tencatt & Bichuette, 2017: 8, fig. 6b), whereas remaining species present clearly smaller and roundish or irregular platelets (see Tencatt & Bichuette, 2017: 8, fig. 6a). Additionally, *A. velites* presents dorsal- and pectoral-fin spines with extremely reduced ossified portion, which is also a potentially exclusive to it. Contrary to Britto *et al.* (2002: 731), the presence of spine in dorsal and pectoral fins was considered for all specimens, though strongly reduced, since they are clearly distinct from the remaining rays (Fig. 73).

In the original description, the authors also mentioned the presence of another unique feature, a reduced and narrow posterior process of the parieto-supraoccipital (see Britto *et al.*, 2002: 733), which was confirmed herein. However, the length of the process itself is not so different from what is observed in some species, like *A. mephisto* (see Tencatt & Bichuette, 2017: 7, fig. 4). On the other hand, a narrow parieto-supraoccipital posterior process was only observed in *A. velites*. Despite Britto *et al.* (2002: 733) presented the widely-spaced counterparts of the dorsolateral on predorsal region of body as an exclusive feature for *A. velites*, Wosiacki *et al.* (2014: 315) recently reported a similar condition for *A. gabrieli*.

As pointed out by Tencatt & Bichuette (2017: 8), *A. velites* lacks dorsal-fin spinelet (Fig. 72a), though a single specimen presented a small platelet-like bony structure stuck to dorsal-fin spine base (Fig. 72b). Among the Callichthyidae, the only species sharing this feature so far is *Callichthys callichthys*, and it is reasonable to assume that this character had arisen independently for these taxa. These authors also mentioned the unusual position of the parieto-supraoccipital fontanel, which is located close to origin of posterior process (see Tencatt & Bichuette, 2017: 7, fig. 4b; Fig. 71b), whereas in remaining Callichthyidae with parieto-supraoccipital fontanel, this structure is generally located mesially on bone, with exception of *A. lakoi*, in which it is slightly displaced towards anterior portion of the bone, and some

specimens of *A. albater*, which presents it slightly displaced towards posterior portion of the bone.

Material examined. In addition to the material examined by Britto *et al.* (2002: 728–729), the following material was analysed. all from Brazil, upper rio Araguaia basin. LIRP 4435, 14 of 16, 19.6–26.6 mm SL, 2 CS of 16, 22.7–23.4 mm SL, Mato Grosso State, córrego do Sapo. LIRP 4446, 8, 16.9–21.9 mm SL, Goiás State, rio Araguaia. LIRP 4479, 11 of 12, 18.6–29.0 mm SL, 1 CS of 12, 22.0 mm SL, Goiás State, rio Araguaia. LIRP 4492, 5, 19.7–22.2 mm SL, Mato Grosso State, córrego do Sapo.

1.4 IDENTIFICATION KEY TO THE SPECIES OF *ASPIDORAS*

1. Reduced preadipose azygous plates _____ 2
- 1'. Non-reduced preadipose azygous plates _____ 3
2. Pigmentation conspicuously reduced; parieto-supraoccipital fontanel located mesially on bone _____ *A. mephisto*
- 2'. Pigmentation not reduced; parieto-supraoccipital fontanel located posteriorly on bone _____
_____ *A. velites*
3. Frontal bone relatively thick, with width equal to or slightly larger than half of entire length (variable in *A. fuscoguttatus*) _____ 4
- 3'. Frontal bone narrow, with width smaller than half of entire length (variable in *A. fuscoguttatus*) _____ 8
4. Fontanel on parieto-supraoccipital slightly displaced towards anterior portion of the bone; anterodorsal portion of infraorbital 1 with a pointed process _____ *A. lakoi*
- 4'. Fontanel on parieto-supraoccipital located mesially or slightly displaced towards posterior portion of the bone; anterodorsal portion of infraorbital 1 lacking a pointed process _____ 5
5. Dorsolateral body plates on predorsal region clearly more distant from their counterparts _____
_____ *A. gabrieli*
- 5'. Dorsolateral body plates on predorsal region touching their counterparts or clearly closer to their counterparts _____ 6
6. Infraorbital 1 with anterior laminar expansion ranging from strongly reduced, at the same level as the posterior margin of nasal capsule, to moderately-developed, reaching to the middle of the nasal capsule _____ *A. albater*

- 6'. Infraorbital 1 with anterior laminar expansion ranging from well developed, surpassing middle of the nasal capsule, to extremely well developed, reaching to anterior margin of the nasal capsule _____ 7
7. Absence of a light and somewhat irregular band on middle portion of the dorsolateral body plates, which runs parallel to flank midline from the region just anterior to dorsal fin to the caudal peduncle, being united with the stripe of the other side of the body in the predorsal region _____ *A. fuscoguttatus*
- 7'. Presence of a light and somewhat irregular band on middle portion of the dorsolateral body plates, which runs parallel to flank midline from the region just anterior to dorsal fin to the caudal peduncle, being united with the stripe of the other side of the body in the predorsal region _____ *A. rochai*
8. Thick, longitudinal conspicuous dark brown stripe along dorsal portion of flank present _____ *A. brunneus*
- 8'. Thick, longitudinal conspicuous dark brown stripe along dorsal portion of flank absent _____ 9
9. Dark brown or black markings on pelvic fin more numerous and/or evident _____ *Aspidoras* sp.
- 9'. Dark brown or black markings on pelvic fin, when present, less numerous and/or evident _____ 10
10. Anterior portion of infraorbital 1 with strongly reduced expansion, not reaching to or at same level as posterior margin of nasal capsule _____ *A. psammatides*
- 10'. Anterior portion of infraorbital 1 with at least poorly-developed expansion, slightly surpassing posterior margin of nasal capsule _____ 11
11. Dark brown or black stripe from anteroventral portion of eye to upper lip lateral area generally present and more evident _____ 12
- 11'. Dark brown or black stripe from anteroventral portion of eye to upper lip lateral area, when present, less evident _____ 15
12. Dark brown or black blotches on dorso- and/or ventrolateral body plates fused with flank midline blotches _____ *A. kiriri*
- 12'. Dark brown or black blotches on dorso- and ventrolateral body plates not fused with flank midline blotches _____ 13
13. Dorsal fin generally with small dark brown or black spots and markings on ventrolateral body plates generally more numerous and evident, not considering the number of blotches in the series along flank midline _____ 14

- 13'. Dorsal fin generally lacking small spots and markings on ventrolateral body plates, when present, generally less numerous and less evident, not considering the number of blotches in the series along flank midline _____ *A. raimundi*
14. Infraorbital 1 clearly asymmetrical _____ *A. belenos*
- 14'. Infraorbital 1 roughly symmetrical _____ *A. poecilus*
15. Flanks sparsely covered by small dark brown or black markings _____ *A. depinnai*
- 15'. Flanks densely covered by small dark brown or black markings _____ 16
16. Top of the head lacking relatively large, well-defined dark brown or black blotches _____
 _____ *A. fuscoguttatus*
- 16'. Top of the head with relatively large, well-defined dark brown or black blotches _____
 _____ *A. maculosus*

1.5 DISCUSSION

Since its description in 1907 by Ihering, some attempts to provide a more accurate diagnosis for *Aspidoras* were presented (Gosline, 1940; Nijssen & Isbrücker, 1976; Reis, 1998; Britto, 2003; Vera-Alcaraz, 2013). Among all putative diagnostic features presented so far, only two of them is present in all species of *Aspidoras*, and, even though they are not exclusive, are effective for the recognition of the genus when combined: the presence of two cranial fontanels, the posterior one in the parieto-supraoccipital and the anterior one between frontals, pointed out for the first time by Nijssen & Isbrücker (1976), and ossified portion of pectoral- and dorsal-fin spines reduced, mentioned for the first time by Reis (1998). Recently, Oliveira *et al.* (2017: e160118[5], fig. 5) and Tencatt & Bichuette (2017: 10, fig. 7) presented an apparently exclusive feature for the genus, the presence of small laminar expansions on base of pectoral-fin branched rays, which can be irregular and form pointed structures. Indeed, this feature was not observed in any species of the remaining genera of Callichthyidae examined herein, being, then, the most incisive characteristic to recognize *Aspidoras*.

Contrary to what is suggested in previous studies (Nijssen & Isbrücker, 1976; Britto, 1998, 2000; Lima & Britto, 2001; Britto *et al.*, 2002; Leão *et al.*, 2015), some *Aspidoras* species are not so restrict regarding their geographical distribution, such as *A. albater*, which can be found in the rivers Araguaia, Paraguay, Paraná and Tocantins basins, *A. poecilus*, present in the rivers Araguaia, Tapajós, Tocantins and Xingu basins, and *A. raimundi*, that occurs in the rivers Parnaíba, São Francisco, Tocantins, Acaraú, Coreaú and Jaguaribe basins. It is important to highlight that the three aforementioned species do not present disjunct geographical distribution, occurring in intermediary regions and also in the border regions between these

basins (see Fig. 9). Although some species present a small known distribution area, as the case of *A. belenos*, *A. depinnai*, *A. kiriri*, *A. lakoi*, *A. maculosus*, *A. rochai*, *A. velites* and *Aspidoras* sp., their available material is relatively scarce, suggesting that more collection efforts are necessary to better comprehend their distribution. Nevertheless, the existence of endemism in *Aspidoras* can not be discarded, as for *A. mephisto*, that in spite of the great collecting effort performed in the region, it is still only known from the Anésio-Russão cave system in Goiás State, occupying an area of about 6 km² (Tencatt & Bichuette, 2017: 21).

There is a vast literature illustrating the presence of homoplastic color patterns in Corydoradinae (Nijssen & Isbrücker, 1980b; Britto, 2003; Britto *et al.*, 2009; Alexandrou *et al.*, 2011; Tencatt *et al.*, 2013; Tencatt & Pavanelli, 2015; Tencatt & Britto, 2016; Tencatt & Ohara, 2016a,b; Lima & Sazima, 2017), which are generally reported as cases of mimicry (Alexandrou *et al.*, 2011; Lima & Sazima, 2017). Despite of that, no case including *Aspidoras* was reported so far. In general, the species within *Aspidoras* share a similar color pattern, characterized by a longitudinal series of dark brown or black blotches plus dark brown or black markings above and below it. One of the possible cases of mimicry is between *A. fuscoguttatus* and/or *A. lakoi* and *Corydoras difluviatilis* Britto & Castro, 2002, which are sympatric in the Grande River basin and share not only a similar color pattern but also general body shape. A similar situation can be observed between *A. fuscoguttatus* and a species of *Corydoras* attributed to *C. flaveolus* in the Tietê River basin. Another example is *Corydoras cochui* Myers & Weitzman, 1954, which is sympatric to *A. albater*, *A. belenos*, *A. poecilus* and *Aspidoras* sp. in the upper portion of the Araguaia River basin, and also presents a remarkably similar color pattern to all of them. Considering color pattern plus general body shape, *C. cochui* is clearly more similar to *A. albater* and *A. poecilus* by having a clearly rounded snout, which is not present in *A. belenos* and *Aspidoras* sp.

The presence of a *Corydoras* specimen among *A. raimundi* paralectotypes was observed herein (see Remarks for *A. raimundi*), and it seems to be a lineage 1 species *sensu* Alexandrou *et al.* (2001). The only known lineage 1 species from the Parnaíba River basin is *C. treitlii*, and though the specimen is quite faded, it was possible to observe a longitudinal series of brownish spots along its flank midline (Fig. 65), which is present in juvenile *C. treitlii* (Fuller, 1999: 38, fig. 18). The presence of juveniles of a larger species sharing similar color pattern with adult specimens of a smaller one was already reported between two species of *Corydoras*, *C. garbei* and *C. lymnades* (Tencatt *et al.*, 2013). However, contrary to what is observed in *Corydoras*, that often presents pairs or trios of syntopic species with convergent or shared color patterns (see Alexandrou *et al.*, 2011), no case of syntopy within *Aspidoras* was observed.

As explained by Tencatt & Evers (2016: 20), the C- and CW-number coding system was implemented to avoid the creation of *nomina nuda* by using names originated by the fishkeeping hobby for putative new species. Currently, there are 11 coded species of *Aspidoras*, C35, C36 and C37, said to be from the Araguaia river basin in Goiás, C118, C119 and C125, with locality data listed only as “Brazil”, C158, said to be from da Paz River, a tributary to the Xingu River in Pará, CW52, with unknown origin, CW119, with locality listed only as “Tocantins”, CW126, said to be from the Teles Pires River basin, and CW141, said to be from the Araguaia River basin in Mato Grosso. The examination of photographs of the specimens used to assign the codes allowed most of them to be recognized as described species. *Aspidoras* sp. C35, known as “the black phantom” among aquarium hobbyists due to its intensely pigmented pattern, specially on dorsal fin, is remarkably similar to melanic specimens of *A. albater* from the Tocantins River basin in Goiás (Fig. 37). Though it was not recorded specifically in the Araguaia River basin but rather from the Paraná River basin in Goiás, *A. fuscoguttatus* seems to represent the species attributed to *Aspidoras* sp. C36, as well as C118 and C119, despite their vague collecting data. The species referred as *Aspidoras* sp. C37 and C158 are notably similar and have possible occurrence locality to *A. poecilus*. *Aspidoras* sp. C125 and CW119 likely represent two of the many variable forms of *A. raimundi*. Along with the narrowly compatible locality data, *Aspidoras* sp. CW141 is strongly similar to *Aspidoras* sp. Contrary to the aforementioned coded species, *Aspidoras* sp. CW52 and CW126 could not be addressed to any of the currently known species.

This review is the most comprehensive study regarding the taxonomy of *Aspidoras* so far, and, considering its results, the total number of valid species for the genus was reduced from 24 to 17, from which 10 were redescribed and one was described. Despite of the efforts spent on gathering material, no recent and/or well preserved specimens of *A. brunneus*, *A. carvalhoi* and *A. rochai* was found, and few new information were added in relation to the previous review by Nijssen & Isbrücker (1976). In the case of other species, such as *A. belenos*, *A. depinnai*, *A. lakoi* and *A. maculosus*, the currently available material is relatively scarce and/or geographically restrict, and therefore, more material is necessary for better understanding their geographic distribution and morphological pattern. Following the same line of Nijssen & Isbrücker (1976: 108), this work does not represent the final solution for the taxonomy of *Aspidoras* but an incisive step towards its comprehension.

Comparative material examined. In addition to the specimens listed in Ohara *et al.* (2016), the following specimens were analysed. *Callichthys callichthys*: NUP 15085, 1 CS, 54.9 mm

SL, Brazil, Minas Gerais State, córrego Pinguela, rio São Francisco basin. *Corydoras micracanthus*: BMNH 1897.1.27.8, lectotype, 33.7 mm SL, Argentina, Salta. *Corydoras pauciradiatus*: INPA 34595, 5 of 22, 19.2–22.5 mm SL, Brazil, Roraima State, rio Branco basin; MZUSP 109459, 5 of 22, 16.0–17.6 mm SL, Brazil, Amazonas State, igapó in the igarapé tributary to the rio Jaradi. *Lepthoplosternum pectorale*: NUP 1287, 1 CS, 50.4 mm SL, Brazil, Goiás State, rio Bocaína, upper rio Paraná basin. *Scleromystax virgulatus*: MBML 6750, 6 of 9, 23.4–30.3 mm SL, 2 CS of 9, 32.6–33.7 mm SL, Brazil, Bahia State, córrego Manoelzinho, rio do Norte basin;

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FIGURE LEGENDS

FIGURE 1. Schematic drawing illustrating the applied method for obtaining the measurements from the *Aspidoras* specimens. Abbreviations: dal: distance between dorsal and adipose fins, db: depth of body, dfbl: dorsal-fin base length, hd: head depth, hl: head length, hod: horizontal orbit diameter, iod: interorbital distance, lads: length of adipose-fin spine, lds: length of dorsal-fin spine, lid: least internareal distance, lmb: length of maxillary barbel, lps: length of pectoral-fin spine, mcw: maximum cleithral width, mhcp: minimum height

of caudal peduncle, padid: preadipose distance, pand: preanal distance, pdd: predorsal distance, ppd: prepelvic distance, sl: standard length, sn: snout length.

FIGURE 2. *Aspidoras* sp., new species, holotype, MNRJ uncataloged, 30.0 mm SL, Brazil, Mato Grosso State, Alto Araguaia Municipality, do Sapo Stream, upstream Couto de Magalhães Waterfall. Lateral (a), dorsal (b) e ventral (c) views. Photos by Celso Ikedo.

FIGURE 3. Dorsal view of the head of CS specimens showing the three frontal bone (outlined in black) patterns in *Aspidoras*: (a) narrow, with width slightly smaller than half of entire length (*Aspidoras maculosus*, UFBA 3291, 30.7 mm SL), (b) relatively thick, with width equal to or slightly larger than half of entire length (*Aspidoras albater*, MZUSP 40793, 29.4 mm SL), and (c) strongly narrow, with width clearly smaller than half of entire length (*Aspidoras psammatides*, UNT 9604, 27.3 mm SL). Scale bar = 1 mm.

FIGURE 4. Lateral view of the head of a CS paratype of *Aspidoras* sp., LIRP 4494, 27.0 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 5. Dorsal view of the infraorbital series of CS specimens showing the four inner laminar expansion of infraorbital 1 (white arrows) patterns in *Aspidoras*: (a) extremely well developed (*Aspidoras albater*, MNRJ 13080, 30.9 mm SL), (b) well developed (*Aspidoras fuscoguttatus*, NUP 12677, 36.1 mm SL), moderately developed (*Aspidoras poecilus*, UNT 6249, 30.9 mm SL), and (d) poorly developed (*Aspidoras psammatides*, UNT 9604, 27.3 mm SL). Abbreviations: io1: infraorbital 1, io2: infraorbital 2. Scale bar = 1 mm.

FIGURE 6. *Aspidoras* sp., new species, LIRP 4494, CS paratype, 27.0 mm SL, showing anterodorsal portion of body. Dotted lines indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 7. *Aspidoras* sp., new species, LIRP 4494, CS paratype, 27.0 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the reduced laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 8. *Aspidoras* sp., new species, uncataloged specimen photographed alive. Photo by Cristiano Moreira.

FIGURE 9. Maps showing the geographical distribution of the *Aspidoras*. Map (a): *Aspidoras albater* (type locality: orange circle; non-type localities: black circles), *Aspidoras belenos* (red cross), *Aspidoras brunneus* (possible region of type locality: red “X”), *Aspidoras fuscoguttatus* (type locality: red diamond; non-type localities: white diamonds), *Aspidoras kiriri* (yellow hexagon), *Aspidoras lakoi* (type locality: green pentagon; non-type locality: black pentagon), *Aspidoras mephisto* (blue triangle) and *Aspidoras* sp. (type locality: red star; non-type localities: white star). Map (b): *Aspidoras carvalhoi* plus *Aspidoras rochai* (red “X”), *Aspidoras depinnai* (type locality: green star; non-type localities: black stars), *Aspidoras gabrieli* (red cross), *Aspidoras maculosus* (type locality: yellow hexagon; non-type localities: black hexagon), *Aspidoras poecilus* (type locality: red triangle; non-type localities: black triangles), *Aspidoras psammatides* (type locality: blue diamond; non-type localities: black diamonds), *Aspidoras raimundi* (type locality: red square; non-type localities: white squares) and *Aspidoras velites* (orange circle)

FIGURE 10. *Aspidoras albater*, holotype, MZUSP 12991, 34.2 mm SL, Tocantinzinho River near São João da Aliança, Goiás State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 11. Lateral view of the head of CS specimens of *Aspidoras albater*, showing the variation on its infraorbitals morphology: ventral laminar expansion strongly reduced in (a) and (b) (LBP 1427, 36.7 mm SL and LIRP 4447, 29.4 mm SL, respectively), poorly developed in (c) (MNRJ 11716, X mm SL), and well developed in (d) (MNRJ 13050, X mm SL). Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 12. *Aspidoras albater*, MZUSP 40793, CS, 29.4 mm SL, showing anterodorsal portion of body. Dotted lines indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 13. Dorsal view of pectoral spines in CS specimens of *Aspidoras albater*, showing variations in the morphology of spine: presence of laminar expansion and simple and/or bifid poorly- and/or moderately-developed serrations on its posterior margin in (a) and (b) (MZUSP 114401, 30.1 mm SL and MNRJ 13080, 30.9 mm SL, respectively), (c) with only simple poorly-developed serrations on its posterior margin (LIRP 4472, X mm SL), (d) with only simple and/or bifid poorly-developed serrations on its posterior margin (MNRJ

12779, 31.3 mm SL), and (e) with only simple and/or bifid moderately-developed serrations on its posterior margin (MNRJ 12581, X mm SL). Arrows in (a) indicate the small laminar expansions at the base of branched rays Scale bar = 1.0 mm.

FIGURE 14. *Aspidoras albater*, uncataloged aquarium specimen photographed alive. Photo by Ingo Seidel.

FIGURE 15. Paratypes of *Aspidoras albater*, MZUSP 12992, (a) 25.9 mm SL, (b) 28.8 mm SL, (c) 26.2 mm SL, and (d) 31.2 mm SL, showing general morphological and color patterns in lateral view.

FIGURE 16. *Aspidoras eurycephalus*, holotype, CAS 16010, 29.5 mm SL, Vermelho Stream into das Almas River, Goiás State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo by the California Academy of Sciences.

FIGURE 17. *Aspidoras taurus*, holotype, MZUSP 57154, 52.1 mm SL, Itiquira River, Mato Grosso State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 18. Relatively large specimen of *Aspidoras albater*, LIRP 4472, 40.1 mm SL, showing general morphological and color patterns in lateral view.

FIGURE 19. *Aspidoras belenos*, holotype, MNRJ 12433, 27.3 mm SL, stream at the Primavera do Leste – Paranatinga Road, 82 kilometers north from Primavera do Leste, Mato Grosso State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Victor de Britto.

FIGURE 20. Lateral view of the head of a CS paratype of *Aspidoras belenos*, UFRJ 4419, 22.1 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 21. *Aspidoras belenos*, UFRJ 1206, paratype, showing anterodorsal portion of body. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 22. *Aspidoras belenos*, UFRJ 4419, CS paratype, 22.1 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 23. *Aspidoras belenos*, holotype, MNRJ 12433, 27.3 mm SL, photographed alive. Photo by Cristiano Moreira.

FIGURE 24. *Aspidoras brunneus*, holotype, ZMA 113588, 20.9 mm SL, Serra do Roncador, km 125 of the road Xavantina-Caximbo, Mato Grosso, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Mark Allen.

FIGURE 25. *Aspidoras carvalhoi*, holotype, MNRJ 5230, lectotype, 25.4 mm SL, Canabrava (or Cana Brava) Weir, Guaramiranga, Ceará State, Brazil. Lateral view. Photo by Victor de Brito.

FIGURE 26. *Aspidoras depinnai*, holotype, MZUSP 56214, 32.5 mm SL, stream at the Amaraji – Primavera Road, Pernambuco State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 27. Lateral view of the head of a CS specimen of *Aspidoras depinnai*, UFPB 6194, 28.0 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 28. *Aspidoras depinnai*, MZUSP 56216, paratype, 20.6 mm SL, showing anterodorsal portion of body. Dotted lines indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 29. *Aspidoras depinnai*, UFPB 6194, CS, 28.0 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 30. *Aspidoras depinnai* uncataloged aquarium specimen photographed alive. Photo by Ingo Seidel.

FIGURE 31. Caudal fin of a CS specimen of *Aspidoras poecilus*, UNT 12056, 31.5 mm SL, showing the small cartilage between the principal and procurrent rays (black arrow). Scale bar = 1.0 mm.

FIGURE 32. *Aspidoras fuscoguttatus*, holotype, MZUSP 8573, 29.5 mm SL, Corguinho Stream, Três Lagoas Road, Mato Grosso do Sul State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 33. Lateral view of the head of a CS specimen of *Aspidoras fuscoguttatus*, DZSJRP 9898, 30.8 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 34. *Aspidoras fuscoguttatus*, DZSJRP 9898, CS, 30.8 mm SL, showing anterodorsal portion of body. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 35. *Aspidoras fuscoguttatus*, LISDEBE 5561, CS, 30.4 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 36. *Aspidoras fuscoguttatus* uncataloged aquarium specimens photographed alive. Photo by Robert McLure.

FIGURE 37. Melanic specimen of *Aspidoras albater*, MZUSP 114401, 35.9 mm SL showing general morphological and color patterns in lateral view.

FIGURE 38. *Aspidoras lakoi*, holotype, MNRJ 5292, 30.8 mm SL, stream in the Grotão Forest, Minas Gerais State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Victor de Brito.

FIGURE 39. Infraorbital series of CS specimens of *Aspidoras lakoi*, MNRJ 5293, 30.0 mm SL, in lateral (a) and frontal (b) views, and *Aspidoras albater*, MNRJ 13080, 30.9 mm SL, in frontal (c) view. The white arrow and the black line in (a) and (b), respectively, show the process on anterodorsal portion of infraorbital 1. The black line in (c) shows the anterodorsal portion of infraorbital 1 lacking a process.

FIGURE 40. *Aspidoras lakoi*, holotype, MNRJ 5292, 30.8 mm SL, showing anterodorsal portion of body. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 41. *Aspidoras lakoi*, MNRJ 5293, CS, 30.0 mm SL, showing dorsal view of the pectoral-fin spine. Scale bar = 1.0 mm.

FIGURE 42. *Aspidoras maculosus*, holotype, FMNH 54810, 37.2 mm SL, Paiaia River, Bahia State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Mark Littmann.

FIGURE 43. *Aspidoras maculosus*, MZUSP 88170, topotype, 27.8 mm SL. Dorsal (top), lateral (middle) and ventral (bottom) views.

FIGURE 44. Lateral view of the head of a CS specimen of *Aspidoras maculosus*, UFBA 3291, 30.7 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 45. *Aspidoras maculosus*, UFBA 3291, CS, 30.7 mm SL, showing anterodorsal portion of body. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 46. *Aspidoras maculosus*, UFBA 3291, CS, 30.7 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 47. *Aspidoras maculosus* uncataloged specimen photographed alive. Photo by Angela Zanata.

FIGURE 48. *Aspidoras poecilus*, holotype, IRSNB 560, 29.2 mm SL, creek upstream the Porori Village, left bank of the Xingu River, Mato Grosso State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Mark Allen.

FIGURE 49. Lateral view of the head of CS specimens of *Aspidoras poecilus*, showing the following morphological variation on infraorbitals: ventral laminar expansion moderately developed in (a) (LBP 15895, 27.1 mm SL), and strongly well developed in (b) and (c) (UNT 6249, 30.9 mm SL and CPUFMT 2060, 27.6 mm SL, respectively). Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 50. Anterodorsal portion of body in CS specimens of *Aspidoras poecilus*, showing the following morphological variation: (a) nuchal plate separated from the posterior process of the parieto-supraoccipital by the first dorsolateral body plate (UNT 6249, 30.9 mm SL), (b) nuchal plate separated from the posterior process of the parieto-supraoccipital by the first dorsolateral body plate, with platelets on the region between them, and (c)

nuchal plate nearly touching the posterior process of the parieto-supraoccipital. Dotted lines indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 51. Dorsal view of pectoral fin in CS specimens of *Aspidoras poecilus*, showing the following variations in the morphology of spine: (a) presence of simple and/or bifid moderately-developed serrations on its posterior margin (UNT 6249, 30.9 mm SL), and (b) with simple and/or bifid moderately- and/or well-developed serrations on its posterior margin (LBP 15860, 26.2 mm SL). Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 52. *Aspidoras poecilus* uncataloged specimens photographed alive, showing the less mottled pattern in (a) and the more mottled pattern in (b). Photos (a) and (b) by Ingo Seidel and Cristiano Moreira, respectively.

FIGURE 53. Specimens of *Aspidoras poecilus* showing general morphological and color patterns variations in lateral view; (a) ZUFMS-PIS, uncataloged specimen, X mm SL (b) UNT 6234, 38.8 mm SL, and (c) MNRJ 24640, 25.2 mm SL.

FIGURE 54. *Aspidoras microgalaeus*, holotype, MZUSP 51209, 25.7 mm SL, small tributary to the Culuene River, kilometer 86 of the Paranatinga – Canarana Road, Mato Grosso State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 55. *Aspidoras psammatices*, holotype, MNRJ 28407, 25.7 mm SL, Caldeirão River, Bahia State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Victor de Brito.

FIGURE 56. Lateral view of the head of a CS specimen of *Aspidoras psammatices*, UNT 9604, 27.3 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 57. *Aspidoras psammatices*, UNT 9604, CS, 27.3 mm SL, showing anterodorsal portion of body. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 58. *Aspidoras psammatides*, UNT 9604, CS, 27.3 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 59. *Aspidoras psammatides*, uncataloged specimen, photographed alive. Photo by Marcelo Melo.

FIGURE 60. *Aspidoras raimundi*, lectotype, NMW 61110, 25.5 mm SL, a tributary to the Parnaíba River near Victoria (= Alto Parnaíba), Maranhão State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Anja Palandacic.

FIGURE 61. Lateral view of the head of CS specimens of *Aspidoras raimundi*, showing the following morphological variation on infraorbitals: ventral laminar expansion moderately developed in (a) and (b) (UNT 10106, 28.3 mm SL and MCP 47296, 27.5 mm SL, respectively), and well developed in (c) and (d) (UFPB 9934, 22.4 mm SL and MCP 47283, 27.3 mm SL, respectively). Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 62. Anterodorsal portion of body in CS specimens of *Aspidoras raimundi*, showing the following morphological variation: (a) nuchal plate separated from the posterior process of the parieto-supraoccipital by the first and second dorsolateral body plates (UFPB 9934, 22.4 mm SL), and (b) nuchal plate nearly touching the posterior process of the parieto-supraoccipital, with platelets on the region between them (black arrows) (MCP 47283, 27.3 mm SL). Dotted lines indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 63. Dorsal view of pectoral fin in CS specimens of *Aspidoras raimundi*, showing the following variations in the morphology of spine: (a) presence of simple and/or bifid poorly-developed serrations on its posterior margin (MCP 47283, 27.3 mm SL), and (b) with simple and/or bifid moderately- and/or well-developed serrations on its posterior margin (UFPB 9934, 22.4 mm SL). Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 64. Uncatalogued specimens of *Aspidoras raimundi* photographed alive, showing the following color pattern variations: (a) typical pattern, (b) typical pattern but densely mottled, (c) dorsal fin with smaller blotch plus spots, larger flank midline blotches and

scars small markings, and (d) dorsal fin with almost entirely hyaline membranes and series of dark brown or black spots, larger flank midline blotches, which are variably fused forming longitudinal stripe. Photos by Telton Ramos (a), Ingo Seidel (b and c) and Hans Evers (d).

FIGURE 65. *Corydoras* specimen (19.0 mm SL) found within the type series of *Aspidoras raimundi* (NMW 46795).

FIGURE 66. Specimens of *Aspidoras raimundi* showing general morphological and color patterns variations in lateral view; (a) UFPB 9934, 24.8 mm SL, (b) UFPB 9418, 24.2 mm SL, (c) UFPB 9415, 24.9 mm SL, (d) USNM 213568, paratype, X mm SL, (e) UFPB 9247, 39.3 mm SL, (f) UFRN 1241, 41.1 mm SL, (g) UFPB 7140, 22.2 mm SL, and (h) UNT 14465, 29.4 mm SL. Photos (a) and (h) by Bruno Ferreira.

FIGURE 67. *Aspidoras spilotus*, holotype, ZMA 113590, 34.0 mm SL, dos Macacos Stream, Ceará State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Mark Allen.

FIGURE 68. *Aspidoras menezesi*, holotype, UMMZ 147336, 41.8 mm SL, tributary of the left bank of the Salgado River, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Heok Hee Ng.

FIGURE 69. *Aspidoras rochai*, lectotype, MZUSP 2195, 38.7 mm SL, Guaramiranga, Ceará State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photo in lateral view by Eduardo Baena.

FIGURE 70. *Aspidoras velites*, holotype, MZUSP 74447, 23.6 mm SL, Boiadeiro Stream, Mato Grosso State, Brazil. Dorsal (top), lateral (middle) and ventral (bottom) views. Photos by Willian Ohara.

FIGURE 71. Lateral view of the head of a CS paratype of *Aspidoras velites*, MZUSP 73264, 20.6 mm SL, showing its general infraorbitals pattern. Abbreviations: io1: infraorbital 1, io2: infraorbital 2, sph: sphenotic, cpt: compound pterotic. Scale bar = 1.0 mm.

FIGURE 72. Anterodorsal portion of body in CS specimens of *Aspidoras velites*, showing the following morphological variation: (a) absence of dorsal-fin spinelet and bony platelet (LIRP 4435, 23.4 mm SL), and (b) absence of nuchal plate but presenting a reduced and irregular bony platelet on anterior margin of dorsal-fin spine base (black arrow) (MZUSP

73264, paratype, 20.6 mm SL). Dotted lines in (b) indicate the limits of the tip of the posterior process of the parieto-supraoccipital and anterior tip of the nuchal plate. Abbreviations: np: nuchal plate, dfs: dorsal-fin spine, pso: parieto-supraoccipital. Scale bar = 1 mm.

FIGURE 73. *Aspidoras velites*, LIRP 4479, CS, 22.0 mm SL, showing dorsal view of the pectoral fin. Arrows indicate the small laminar expansions at the base of branched rays. Scale bar = 1.0 mm.

FIGURE 74. *Aspidoras velites*, MZUSP 73247, 27.9 mm SL, photographed alive. Photo by Cristiano Moreira.

Table 1. Morphometric data of the holotype and 19 paratypes of *Aspidoras* sp. SD = standard deviation.

	Holotype	Low-High	Mean±SD
Standard length (mm)	30.0	22.4–30.5	26.3±2.2
Percents of standard length			
Depth of body	29.3	29.1–35.1	31.2±1.5
Predorsal distance	47.0	46.5–51.1	48.6±1.4
Prepelvic distance	49.7	47.3–54.5	50.9±1.8
Preanal distance	76.7	74.9–80.3	78.5±1.3
Preadipose distance	84.0	82.7–87.0	84.6±1.3
Length of dorsal spine	19.0	14.8–22.5	18.3±2.0
Length of pectoral spine	18.7	16.6–20.5	19.0±1.3
Length of adipose-fin spine	9.0	7.4–12.1	9.4±1.2
Depth of caudal peduncle	13.0	13.0–15.2	13.8±0.6
Length of dorsal-fin base	18.0	14.1–18.0	15.7±1.2
Dorsal to adipose distance	21.7	19.2–22.9	20.9±1.2
Maximum cleithral width	26.0	25.9–29.1	27.4±0.9
Head length	37.7	35.4–40.2	37.9±1.2
Length of maxillary barbel	18.3	15.6–23.3	19.0±1.9
Percents of head length			
Head depth	76.1	68.4–86.0	75.8±4.7
Least interorbital distance	38.1	36.7–41.5	38.8±1.3
Horizontal orbit diameter	18.6	17.9–21.0	19.4±0.9
Snout length	49.6	44.2–50.0	47.7±1.5
Least internarial distance	19.5	18.5–23.3	21.1±1.2

Table 2. Morphometric data of the holotype and four paratypes plus 20 non-type specimens of *Aspidoras albater*. SD = standard deviation.

	Holotype	Low-High	Mean±SD
Standard length (mm)	34.2	25.9–39.1	30.7±3.0
Percents of standard length			
Depth of body	25.7	25.6–28.7	27.0±0.9
Predorsal distance	44.7	41.5–46.5	44.6±1.4
Prepelvic distance	50.9	46.0–52.4	48.5±1.3
Preanal distance	81.0	74.6–81.0	77.5±1.5
Preadipose distance	83.9	80.8–86.5	83.6±1.7
Length of dorsal spine	12.6	6.5–14.7	9.4±2.4
Length of pectoral spine	14.9	8.6–16.0	12.0±2.0
Length of adipose-fin spine	–	5.1–10.1	7.6±1.4
Depth of caudal peduncle	12.9	12.8–14.9	13.9±0.6
Length of dorsal-fin base	14.9	10.9–14.9	12.8±1.2
Dorsal to adipose distance	26.3	22.2–30.3	25.4±1.9
Maximum cleithral width	25.4	23.8–26.4	25.2±0.7
Head length	36.3	30.0–37.8	33.1±2.1
Length of maxillary barbel	16.4	13.7–22.3	18.1±2.4
Percents of head length			
Head depth	66.1	62.1–77.0	71.1±4.0
Least interorbital distance	31.5	31.5–44.0	38.7±3.2
Horizontal orbit diameter	16.9	13.7–21.3	17.0±1.6
Snout length	45.2	43.2–51.2	46.8±2.0
Least internarial distance	17.7	17.7–28.0	23.8±3.0

Table 3. Morphometric data of 15 non-type specimens of *Aspidoras depinnai*. Length of dorsal spine could be measured in 19 specimens. SD = standard deviation.

	Low-High	Mean±SD
Standard length (mm)	20.3–35.5	24.9±4.1
Percents of standard length		
Depth of body	26.9–31.1	29.0±1.3
Predorsal distance	42.0–47.7	44.9±1.6
Prepelvic distance	47.0–51.7	49.4±1.1
Preanal distance	75.2–80.5	78.0±1.5
Preadipose distance	82.9–88.7	86.0±1.6
Length of dorsal spine	8.5–13.4	11.8±1.3
Length of pectoral spine	13.8–18.6	15.4±1.3
Length of adipose-fin spine	5.6–10.8	8.5±1.3
Depth of caudal peduncle	14.1–17.1	15.3±0.8
Length of dorsal-fin base	13.7–18.6	15.3±1.3
Dorsal to adipose distance	23.5–28.2	26.0±1.5
Maximum cleithral width	25.1–29.4	27.1±1.4
Head length	33.0–39.2	36.1±1.7
Length of maxillary barbel	16.2–23.0	19.3±2.4
Percents of head length		
Head depth	68.8–76.9	72.3±2.2
Least interorbital distance	33.3–40.7	35.0±1.8
Horizontal orbit diameter	17.7–20.2	18.9±0.8
Snout length	41.6–47.9	45.0±1.6
Least internarial distance	15.6–22.2	18.4±1.7

Table 4. Morphometric data of the holotype and 20 non-type specimens of *Aspidoras fuscoguttatus*. SD = standard deviation.

	Holotype	Low-High	Mean±SD
Standard length (mm)	29.5	26.7–37.2	29.9±2.9
Percents of standard length			
Depth of body	30.8	24.0–31.4	28.2±1.7
Predorsal distance	45.4	41.4–46.0	44.1±1.1
Prepelvic distance	49.8	43.5–49.8	46.9±1.7
Preanal distance	78.3	72.1–78.7	75.5±1.9
Preadipose distance	84.1	82.3–87.7	85.1±1.6
Length of dorsal spine	15.3	12.4–16.2	14.7±1.2
Length of pectoral spine	17.3	12.4–19.6	16.4±1.8
Length of adipose-fin spine	10.8	8.4–11.6	10.2±0.9
Depth of caudal peduncle	15.6	13.8–15.9	14.8±0.7
Length of dorsal-fin base	15.6	11.5–15.6	14.0±1.0
Dorsal to adipose distance	23.4	23.4–31.2	27.4±2.1
Maximum cleithral width	28.1	24.3–29.6	26.6±1.2
Head length	35.6	32.2–35.6	33.6±0.7
Length of maxillary barbel	16.9	16.9–24.2	20.9±2.2
Percents of head length			
Head depth	76.2	69.7–79.8	74.8±2.9
Least interorbital distance	38.1	36.3–43.8	40.1±1.7
Horizontal orbit diameter	17.1	16.7–20.2	18.5±1.1
Snout length	43.8	43.8–51.0	47.2±2.0
Least internarial distance	17.1	14.7–22.6	19.3±1.9

Table 5. Morphometric data of the holotype and 16 non-type specimens of *Aspidoras lakoi*. Length of dorsal and adipose spines, and maxillary barbell could be measured in 15, 8 and 13 specimens, respectively. SD = standard deviation.

	Holotype	Low-High	Mean±SD
Standard length (mm)	30.8	21.7–38.5	27.0±4.7
Percents of standard length			
Depth of body	32.5	30.5–37.1	33.6±1.7
Predorsal distance	46.4	42.1–49.1	45.8±1.8
Prepelvic distance	50.0	46.0–50.9	49.1±1.4
Preanal distance	81.8	80.2–84.3	81.8±1.0
Preadipose distance	89.0	83.1–89.5	86.9±1.9
Length of dorsal spine	–	9.8–13.8	11.9±1.2
Length of pectoral spine	16.9	14.3–21.0	18.2±1.6
Length of adipose-fin spine	–	5.2–10.5	7.9±1.6
Depth of caudal peduncle	15.3	13.3–17.1	15.5±1.0
Length of dorsal-fin base	15.9	14.5–18.9	16.1±1.2
Dorsal to adipose distance	31.2	25.9–33.5	28.8±2.0
Maximum cleithral width	28.2	26.7–30.1	28.7±1.1
Head length	37.0	34.5–38.9	36.7±1.3
Length of maxillary barbel	12.3	10.1–20.0	14.3±2.8
Percents of head length			
Head depth	78.1	78.1–88.2	81.6±2.5
Least interorbital distance	40.4	35.3–42.1	40.0±1.7
Horizontal orbit diameter	16.7	14.9–18.3	16.5±1.2
Snout length	40.4	38.2–43.4	41.1±1.3
Least internarial distance	21.9	21.2–26.3	23.8±1.5

Table 6. Morphometric data of 13 non-type specimens of *Aspidoras maculosus*. SD = standard deviation.

	Low-High	Mean±SD
Standard length (mm)	15.4–30.8	25.8±3.9
Percents of standard length		
Depth of body	25.3–29.9	27.8±1.4
Predorsal distance	43.4–48.3	45.3±1.5
Prepelvic distance	46.8–50.0	48.7±1.3
Preanal distance	77.3–86.0	80.7±2.5
Preadipose distance	80.8–87.6	83.6±2.0
Length of dorsal spine	12.4–17.4	14.7±1.6
Length of pectoral spine	14.3–19.7	17.4±1.6
Length of adipose-fin spine	8.8–13.2	11.0±1.3
Depth of caudal peduncle	13.6–15.7	14.6±0.7
Length of dorsal-fin base	14.5–18.8	16.7±1.3
Dorsal to adipose distance	20.0–23.5	21.5±1.1
Maximum cleithral width	24.1–28.2	25.9±1.4
Head length	34.1–39.7	37.0±1.6
Length of maxillary barbel	14.5–20.2	16.9±1.6
Percents of head length		
Head depth	63.8–74.1	69.8±3.2
Least interorbital distance	29.6–34.8	32.8±1.4
Horizontal orbit diameter	18.3–24.1	20.0±1.5
Snout length	42.2–47.6	44.2±1.6
Least internarial distance	14.0–19.0	17.0±1.5

Table 7. Morphometric data of 40 non-type specimens of *Aspidoras poecilus*. SD = standard deviation.

	Low-High	Mean±SD
Standard length (mm)	19.1–38.8	28.2±4.1
Percents of standard length		
Depth of body	27.0–31.6	29.5±1.1
Predorsal distance	42.5–47.6	45.2±1.3
Prepelvic distance	44.8–51.4	47.7±1.4
Preanal distance	72.4–79.8	77.6±1.4
Preadipose distance	80.5–88.4	85.1±1.6
Length of dorsal spine	10.5–23.3	17.6±3.1
Length of pectoral spine	13.0–22.0	18.1±2.0
Length of adipose-fin spine	7.7–12.0	10.0±1.3
Depth of caudal peduncle	12.9–16.9	14.8±0.8
Length of dorsal-fin base	14.1–17.5	16.1±1.0
Dorsal to adipose distance	20.8–27.9	24.7±1.7
Maximum cleithral width	24.6–28.2	26.6±1.0
Head length	33.3–43.0	36.9±2.0
Length of maxillary barbel	10.1–21.5	17.5±2.3
Percents of head length		
Head depth	57.3–82.4	72.2±4.3
Least interorbital distance	29.0–36.4	33.3±1.5
Horizontal orbit diameter	15.3–21.1	17.9±1.4
Snout length	32.1–49.1	43.7±2.5
Least internarial distance	13.3–20.5	16.6±1.6

Table 8. Morphometric data of 113 non-type specimens of *Aspidoras raimundi*. Length of adipose-fin spine could be measured in 112 specimens. SD = standard deviation.

	Low-High	Mean±SD
Standard length (mm)	15.2–39.3	25.7±4.2
Percents of standard length		
Depth of body	23.8–31.0	27.7±1.6
Predorsal distance	36.6–49.3	45.0±2.0
Prepelvic distance	42.9–52.5	48.6±2.2
Preanal distance	74.0–84.1	78.9±2.2
Preadipose distance	80.8–88.2	83.9±1.7
Length of dorsal spine	9.6–22.0	16.2±2.6
Length of pectoral spine	12.8–23.6	18.0±2.0
Length of adipose-fin spine	7.5–13.3	10.4±1.1
Depth of caudal peduncle	12.5–16.7	14.5±0.8
Length of dorsal-fin base	11.2–17.6	15.2±1.2
Dorsal to adipose distance	18.4–29.9	24.2±2.1
Maximum cleithral width	22.8–28.3	25.5±1.3
Head length	29.8–46.3	37.3±2.3
Length of maxillary barbel	4.7–22.1	13.4±3.6
Percents of head length		
Head depth	56.8–75.3	69.0±2.6
Least interorbital distance	26.3–38.1	32.3±2.0
Horizontal orbit diameter	17.3–24.4	20.4±1.6
Snout length	31.6–49.2	42.1±2.6
Least internarial distance	12.2–20.2	16.0±1.6

Figure 1.

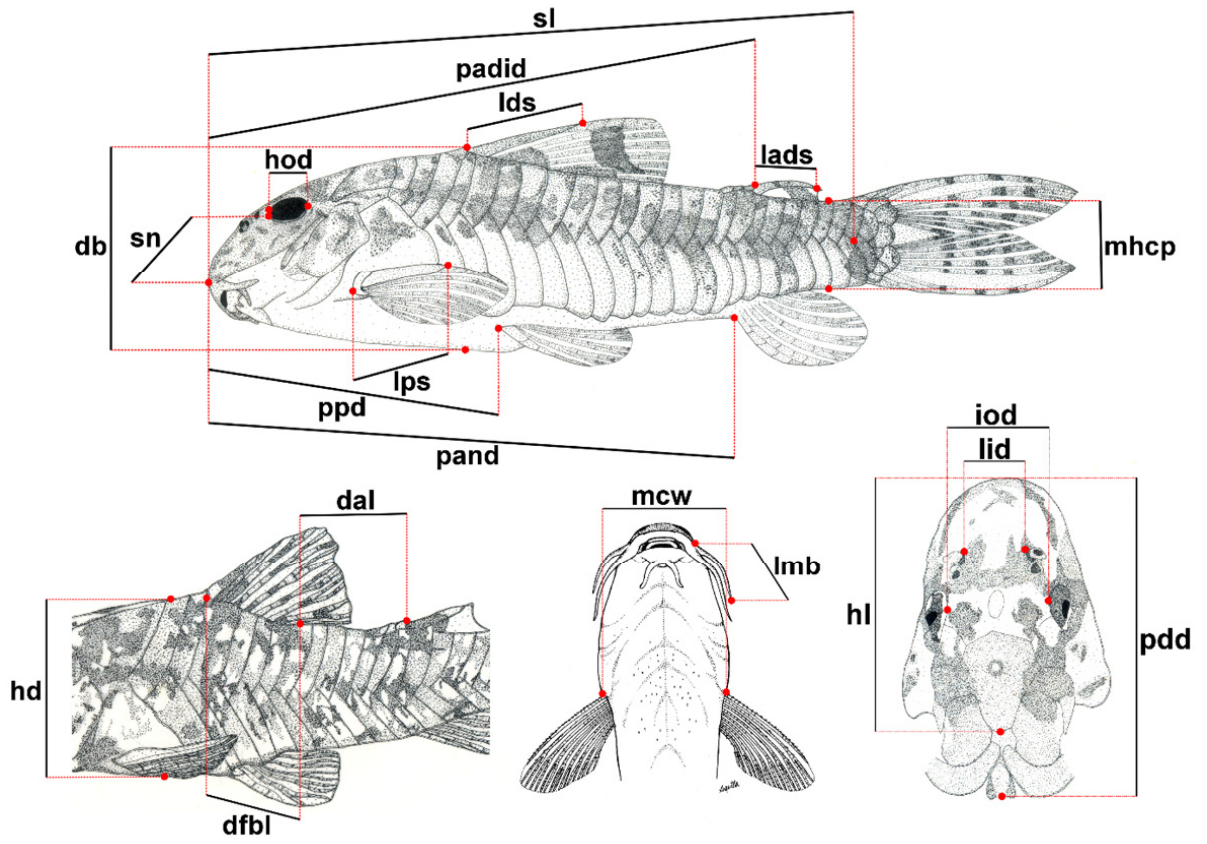


Figure 2.



Figure 3.

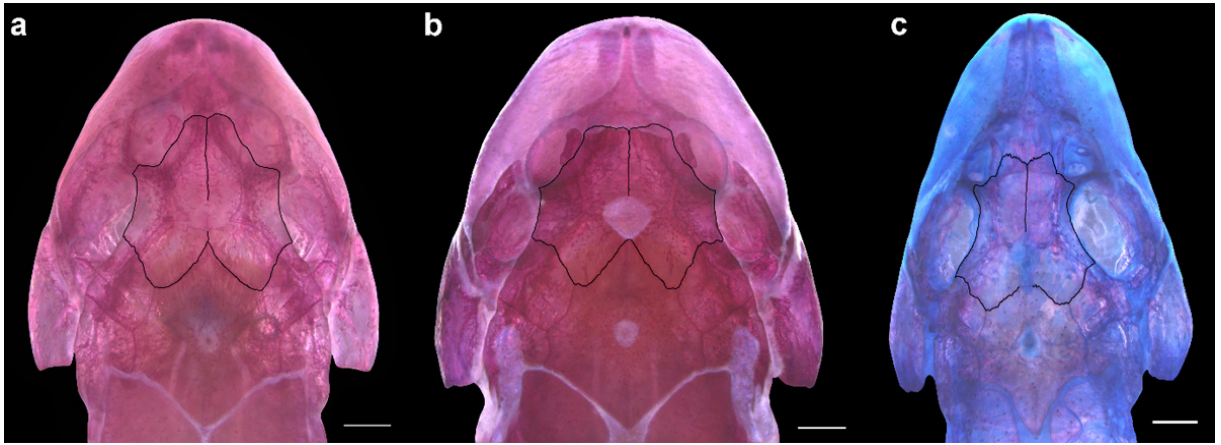


Figure 4.

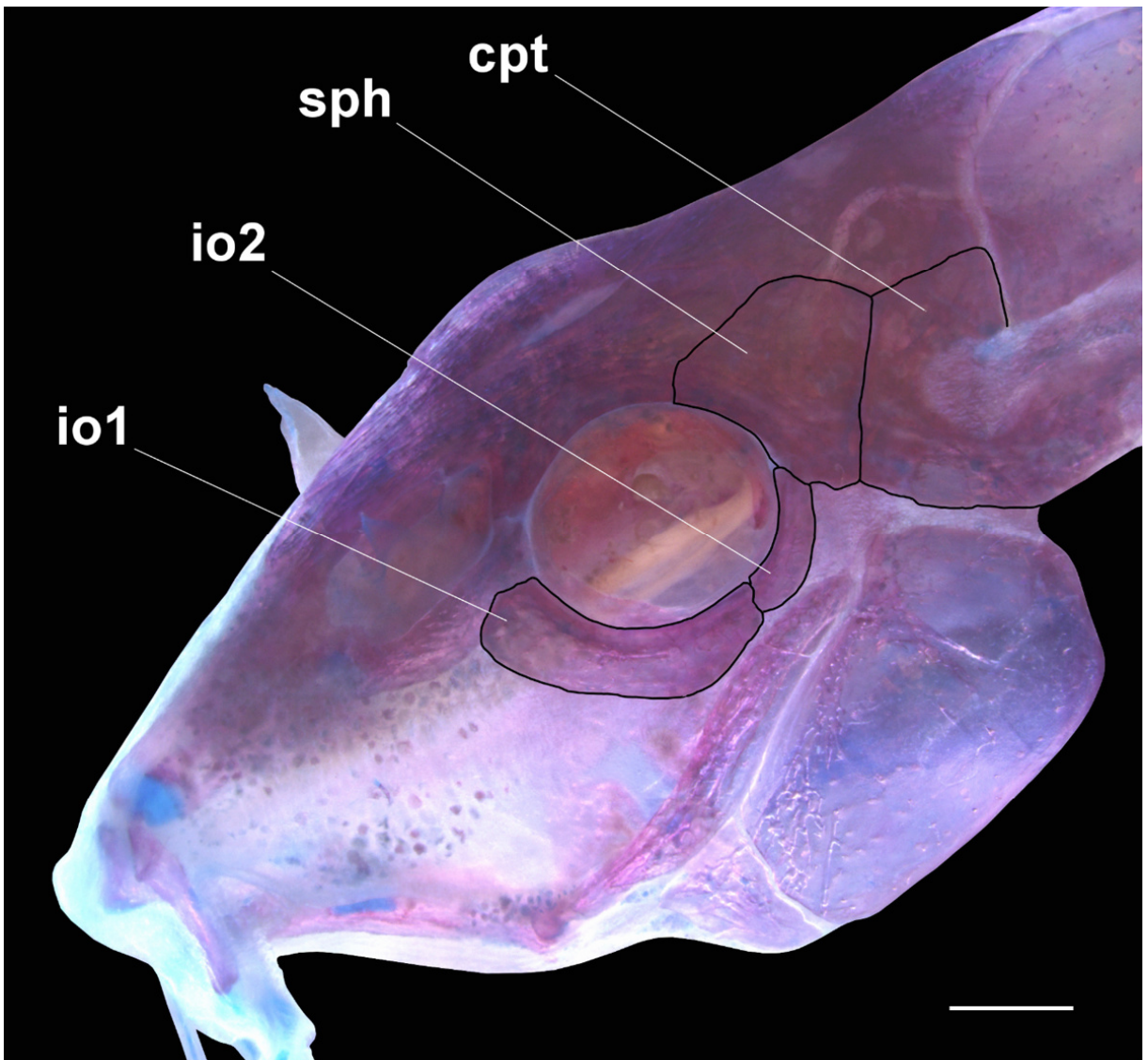


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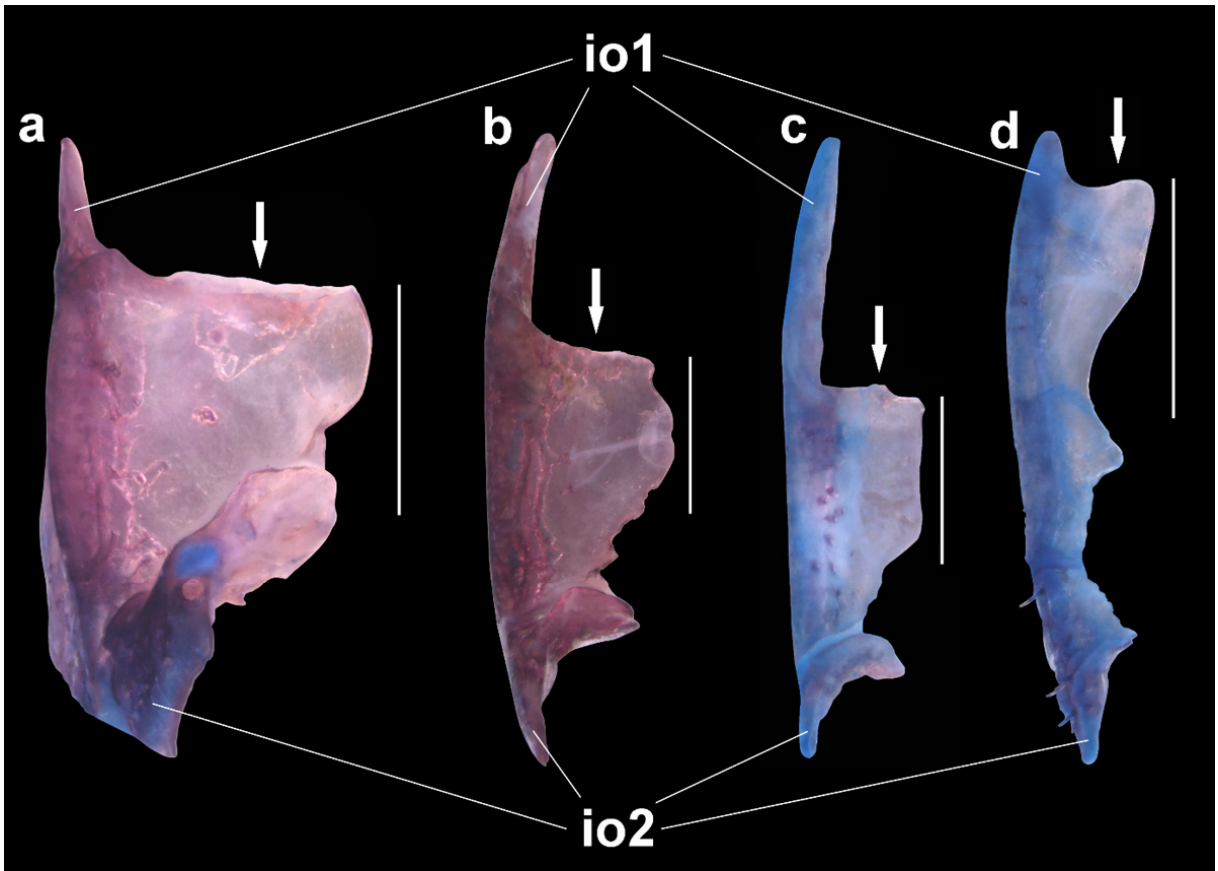


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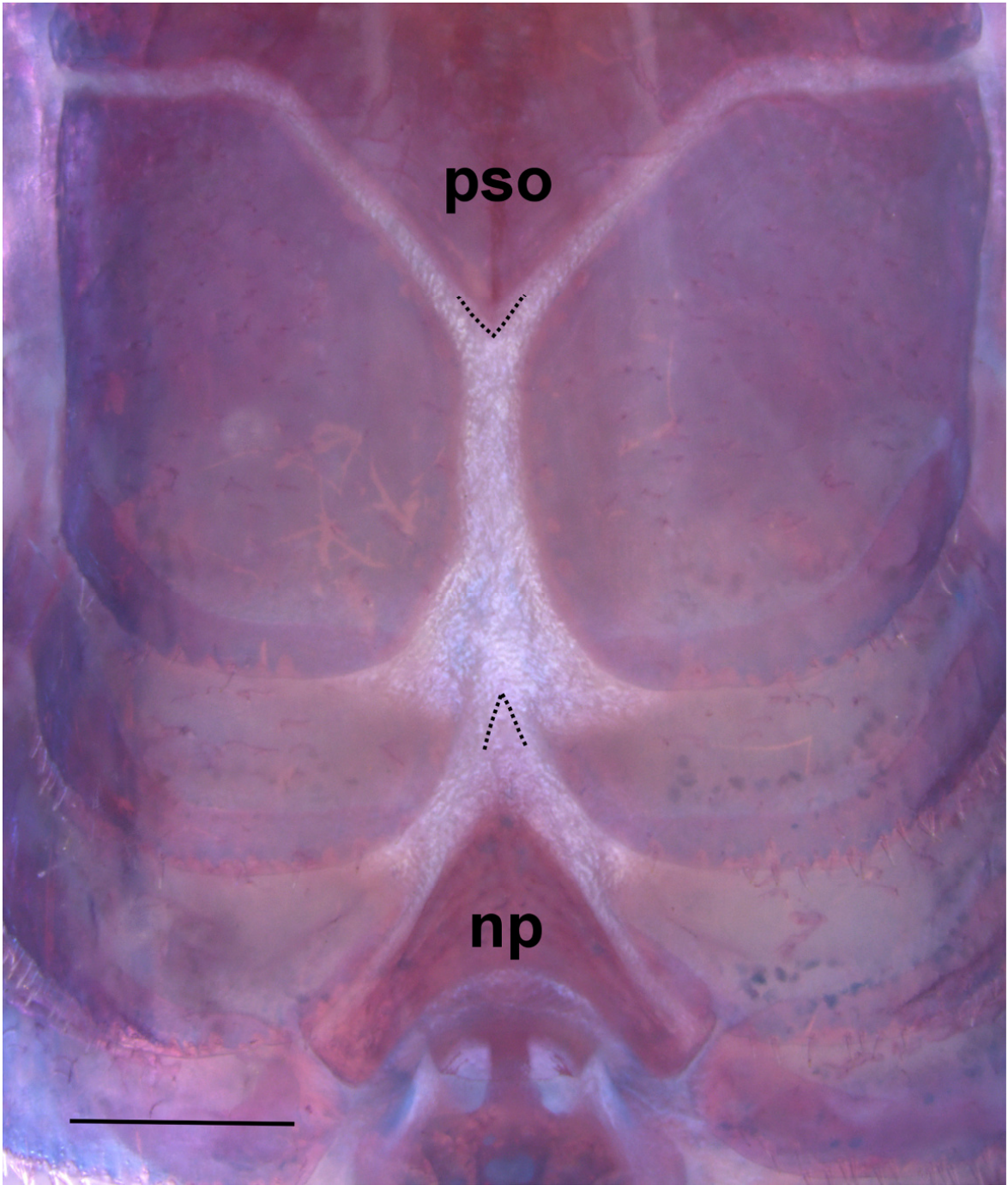


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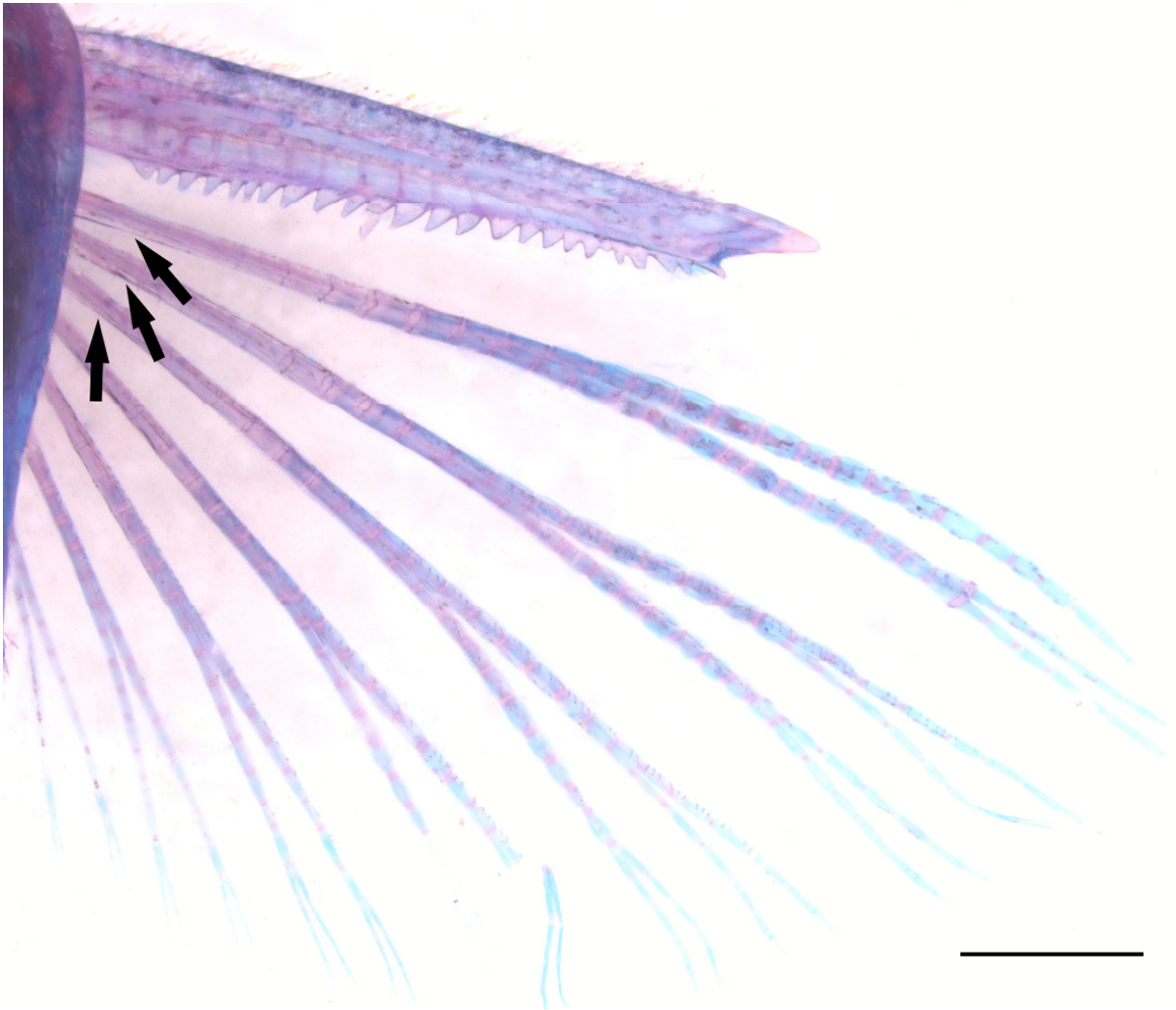


Figure 8.



Figure 9.

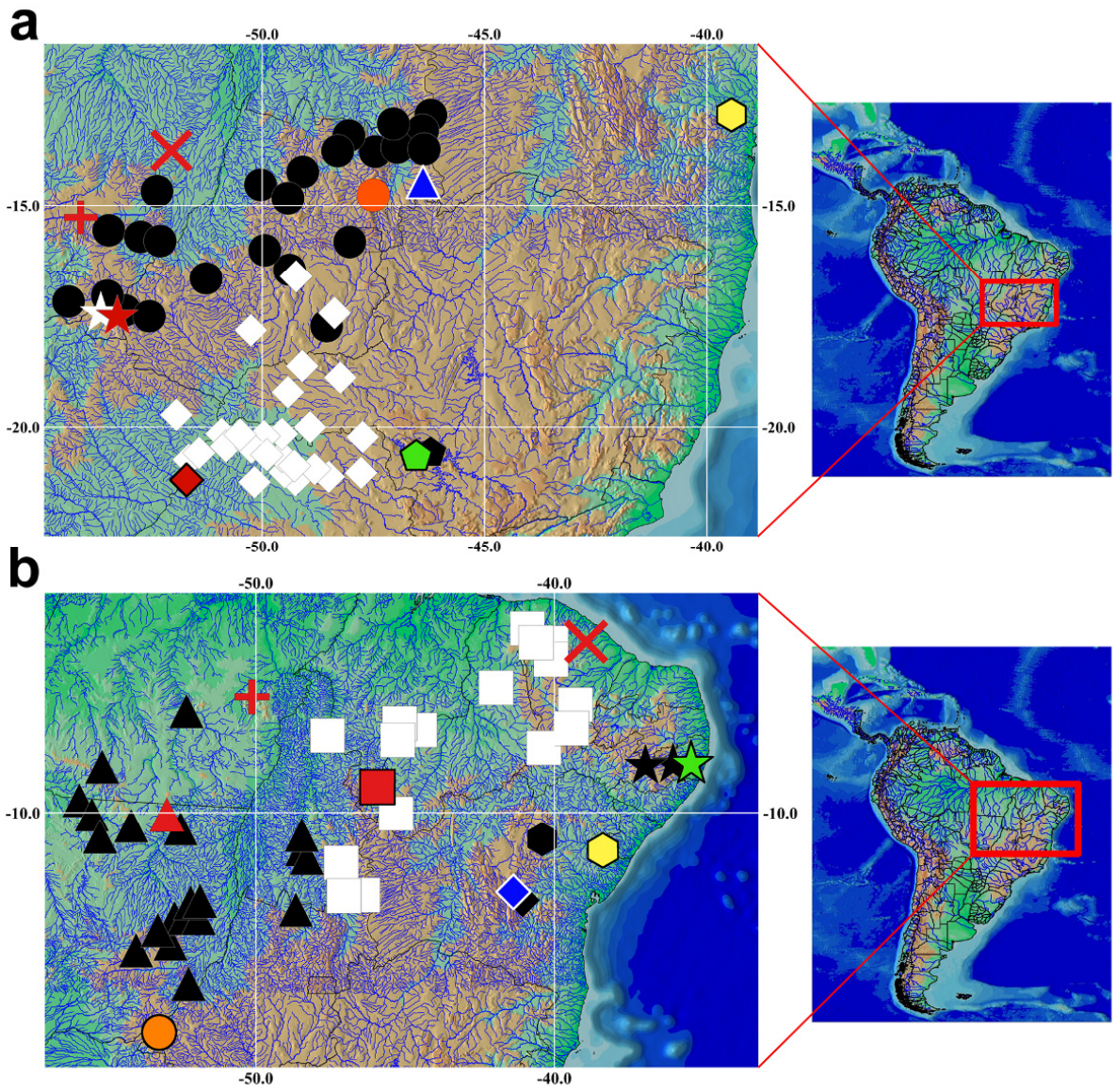


Figure 10.



Figure 11.

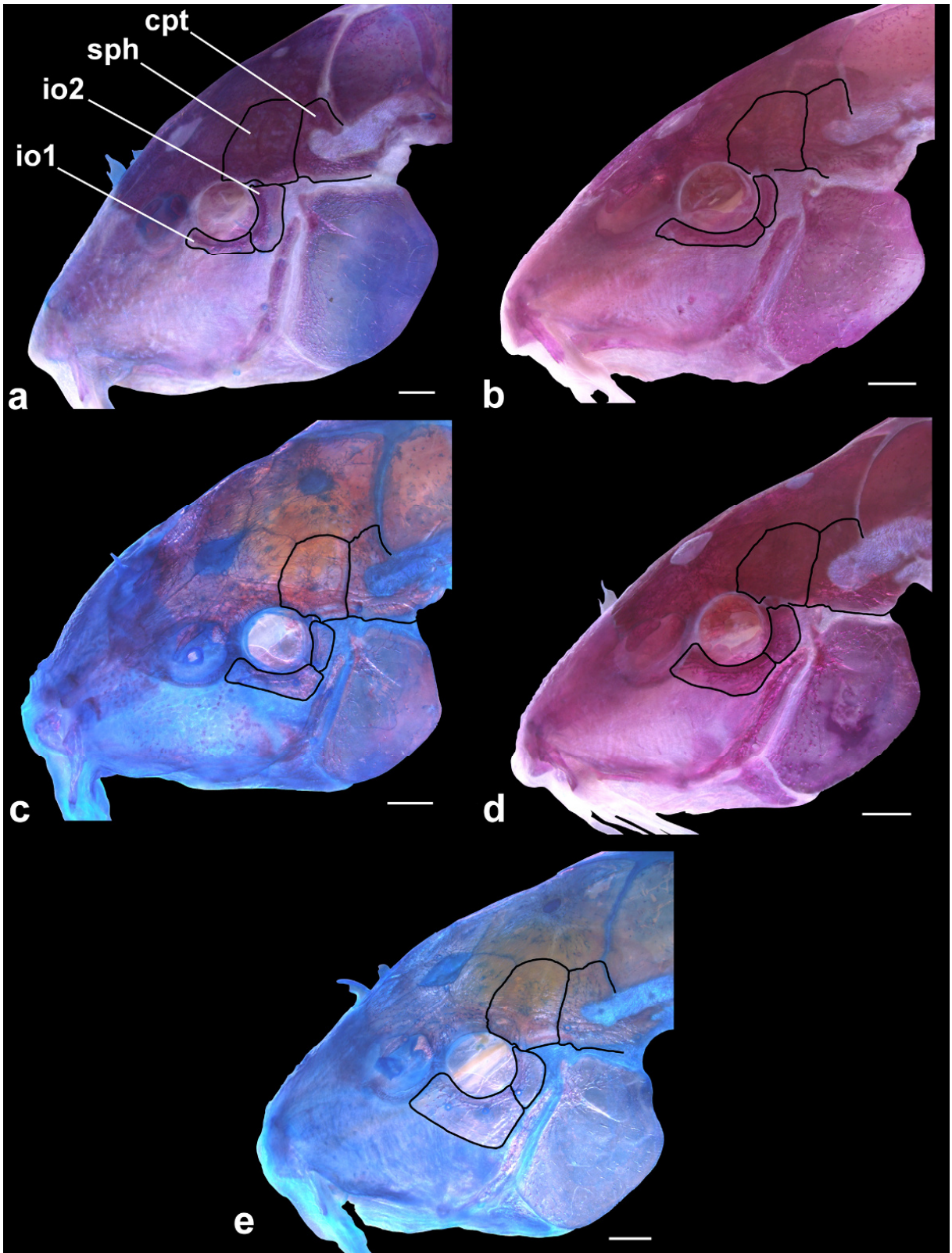


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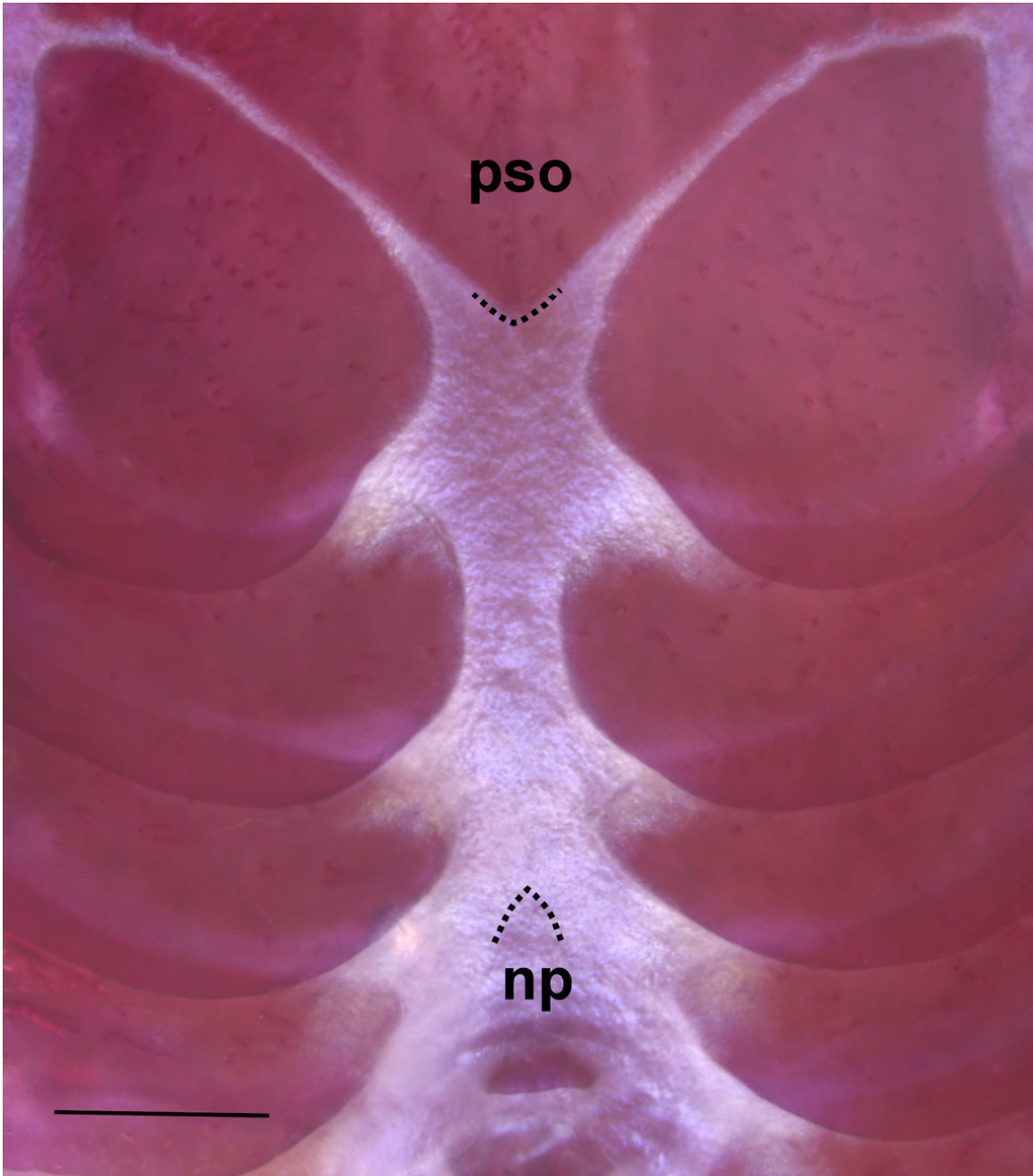


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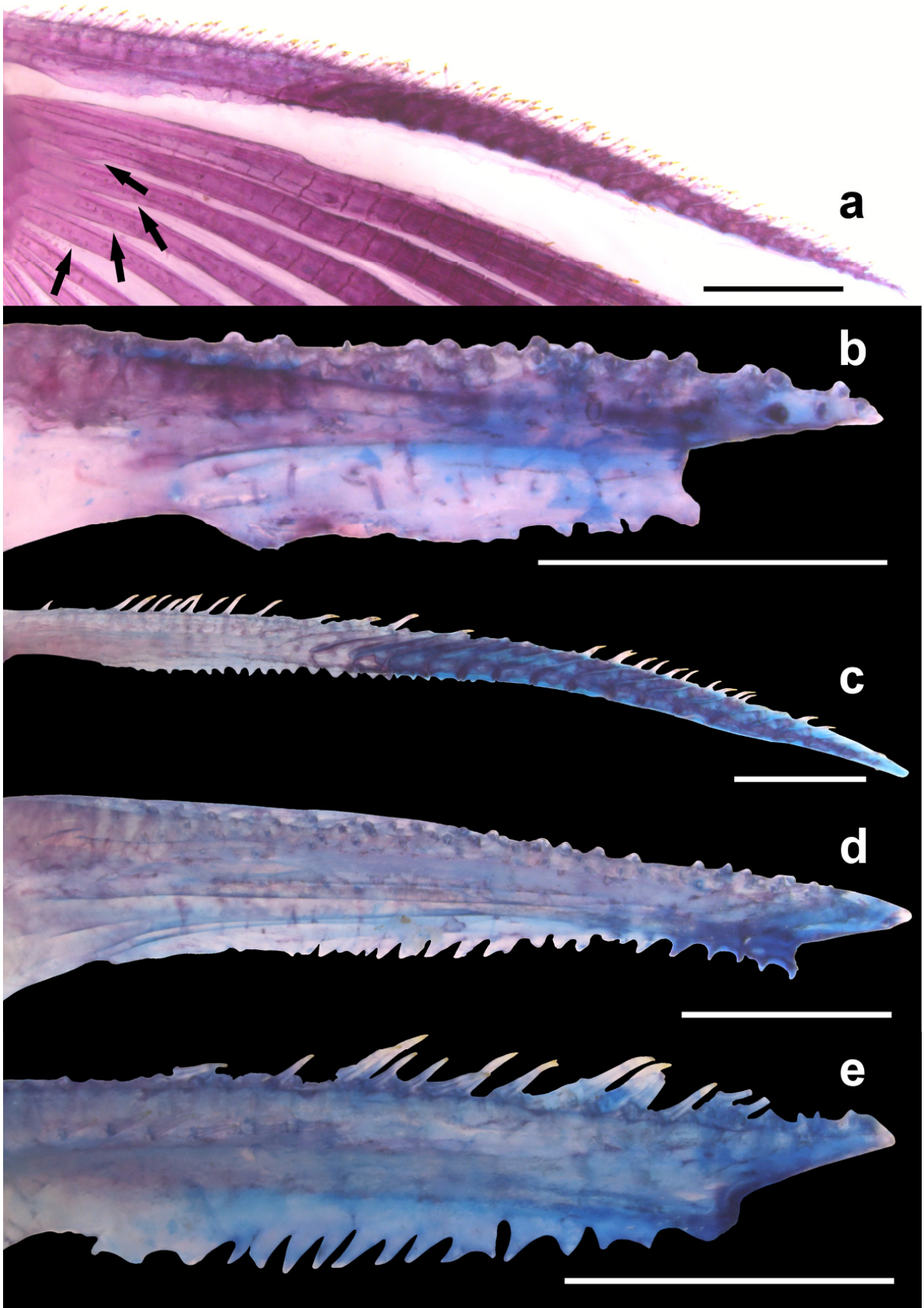


Figure 14.



Figure 15.

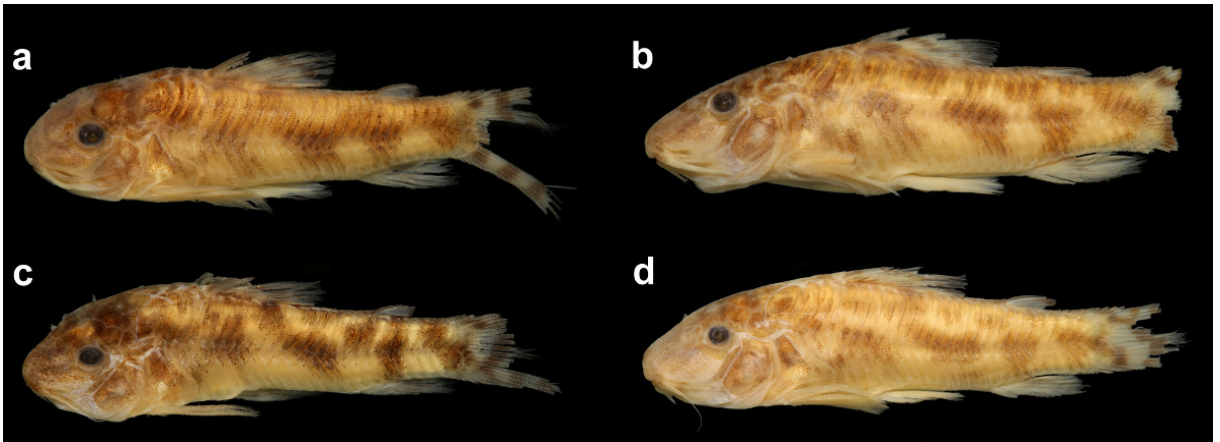


Figure 16.



Figure 17.



Figure 18.



Figure 19.



Figure 20.

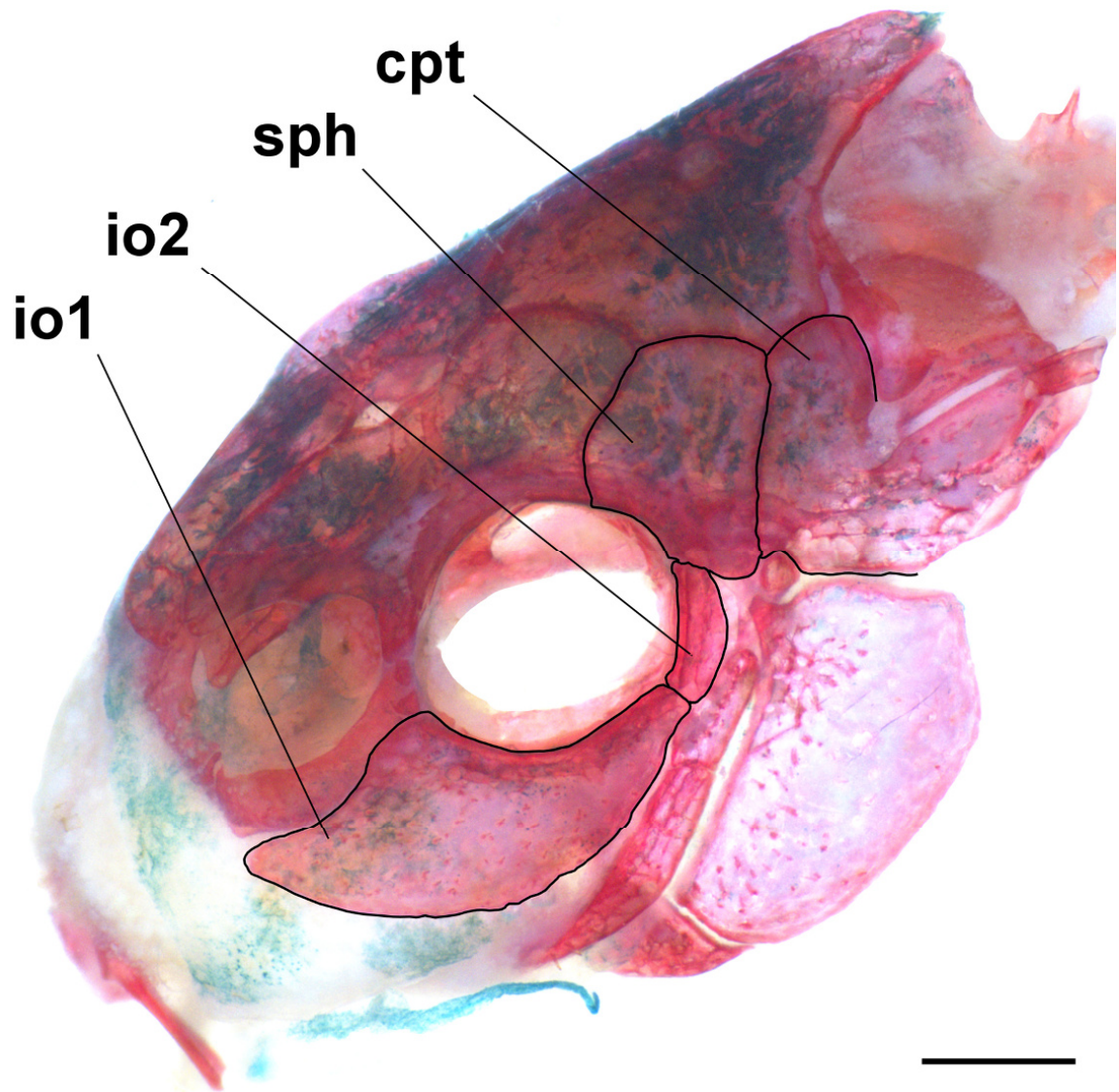


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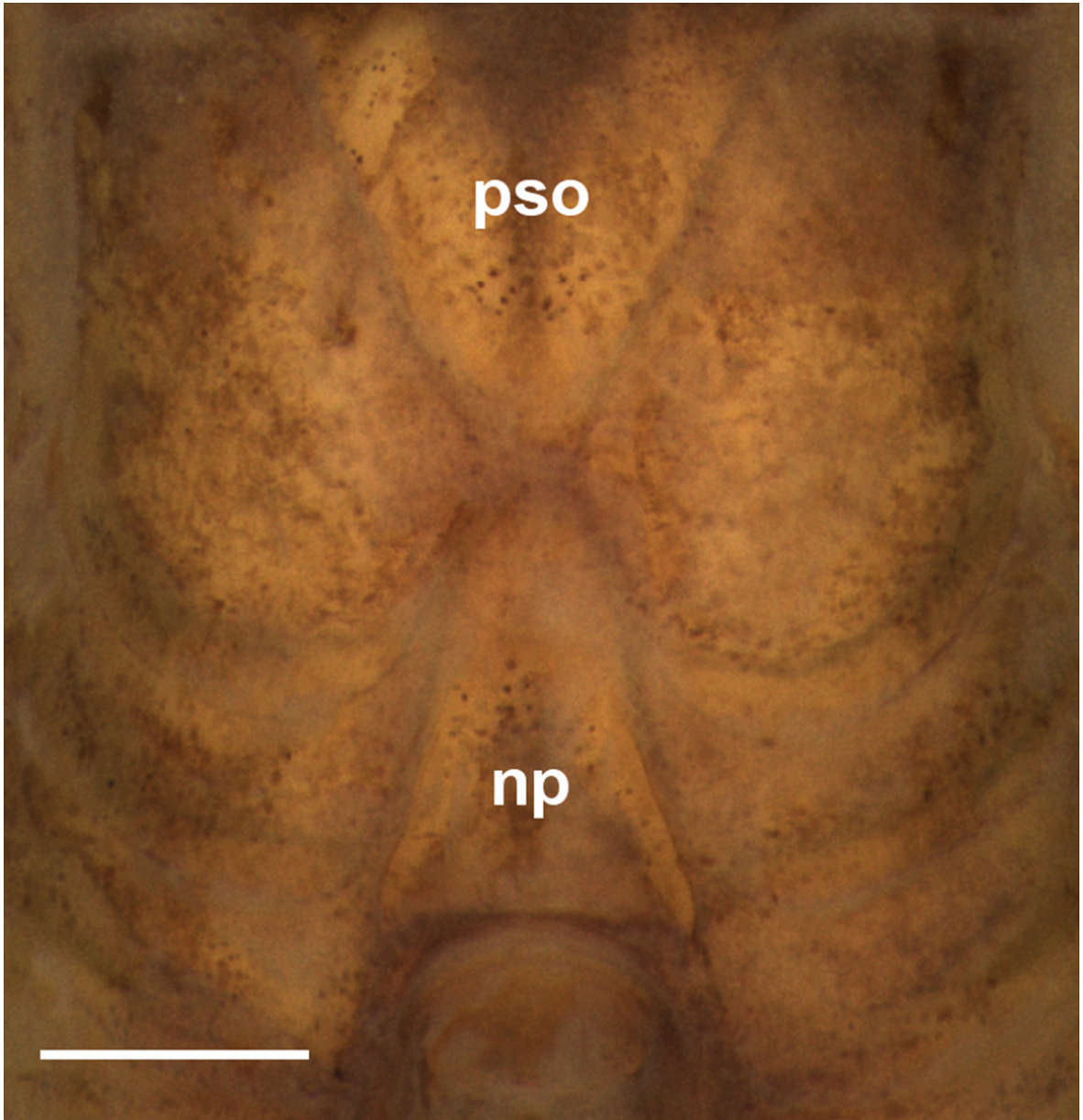


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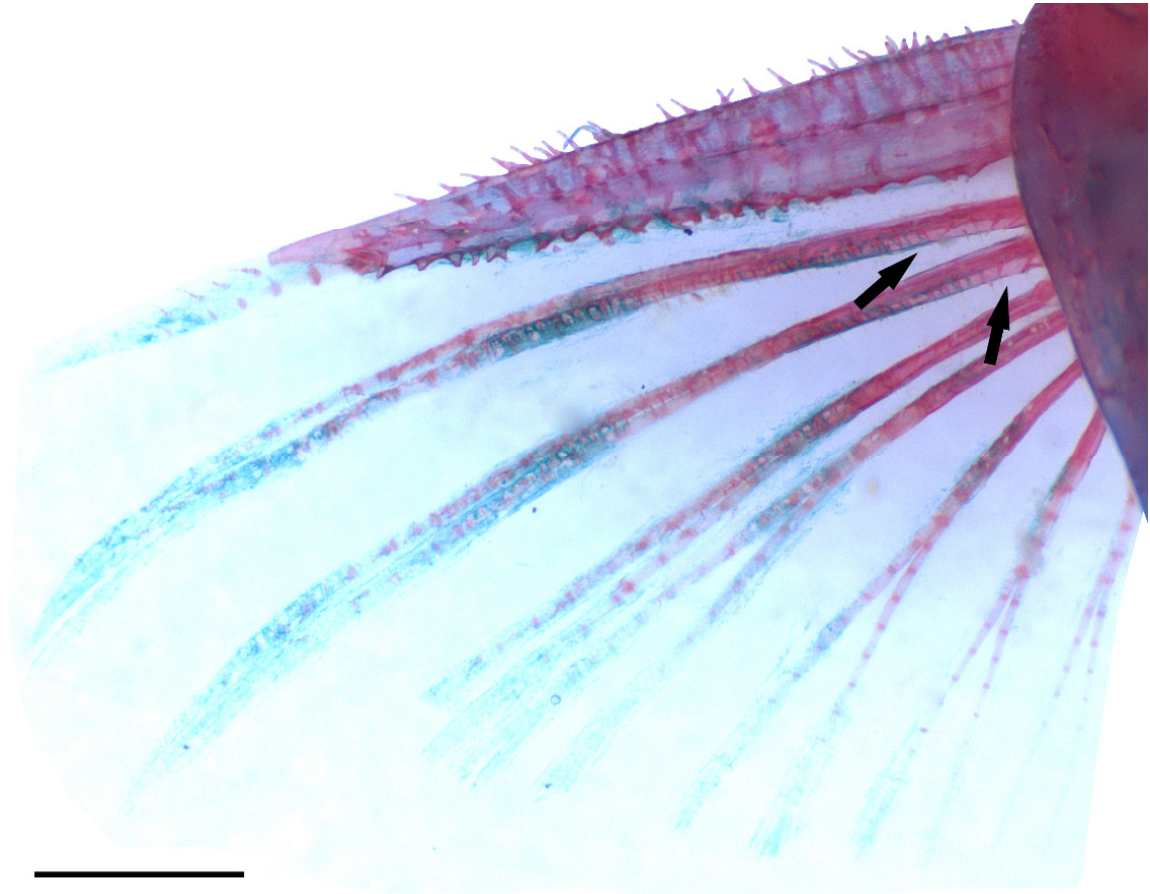


Figure 23.



Figure 24.



Figure 25.



Figure 26.



Figure 27.

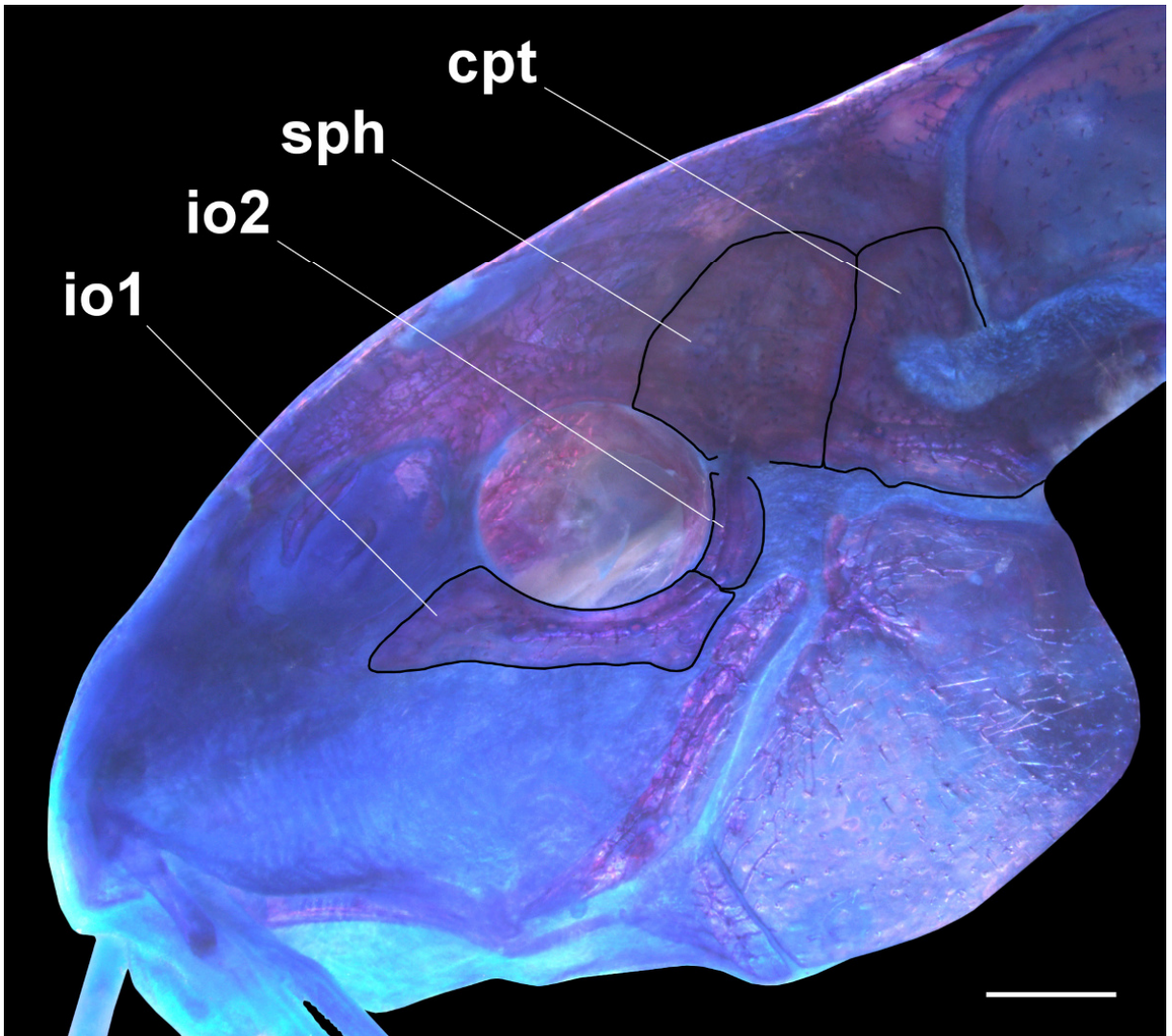


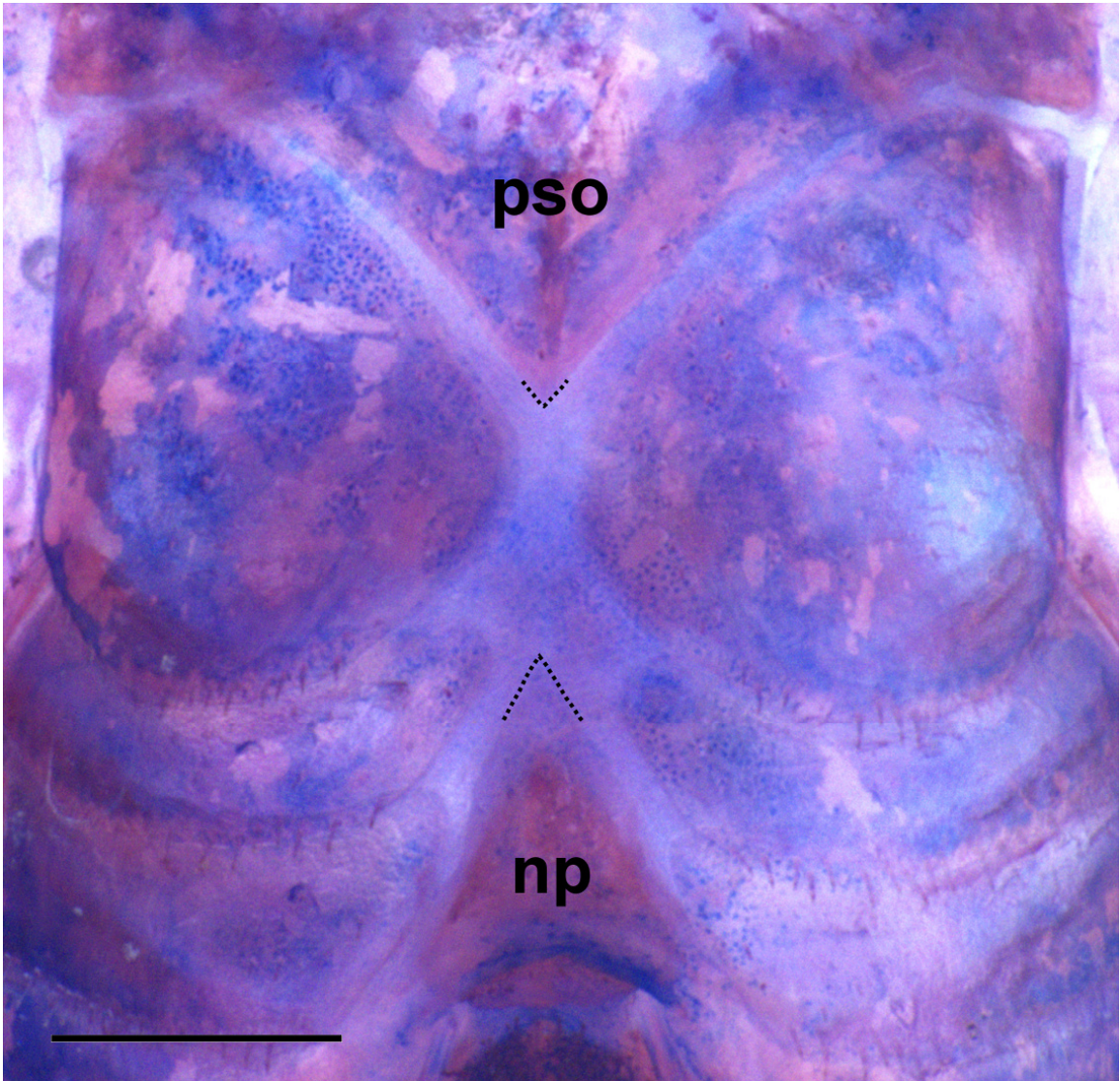
Figure 28.

Figure 29.

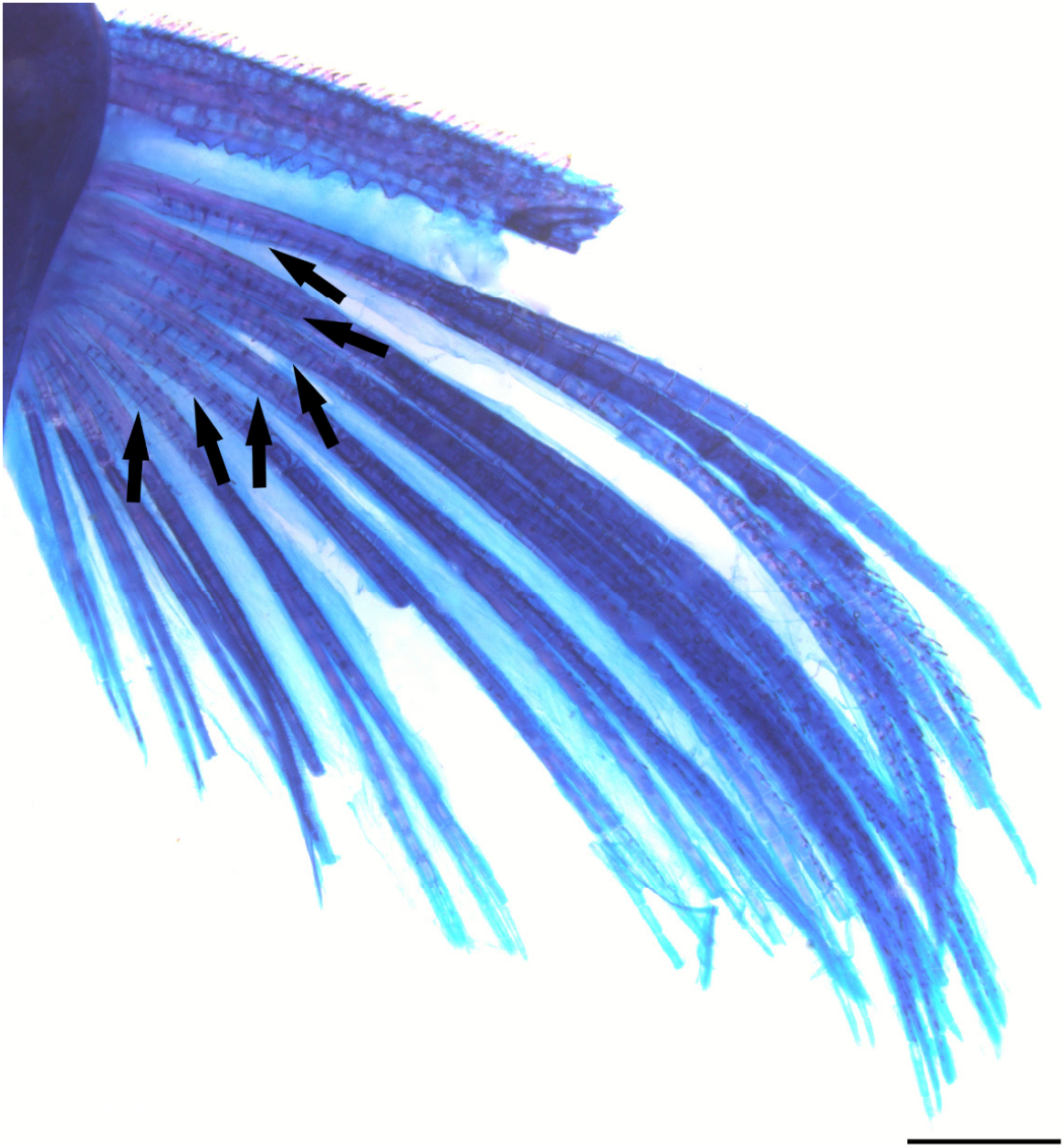


Figure 30.



Figure 31.

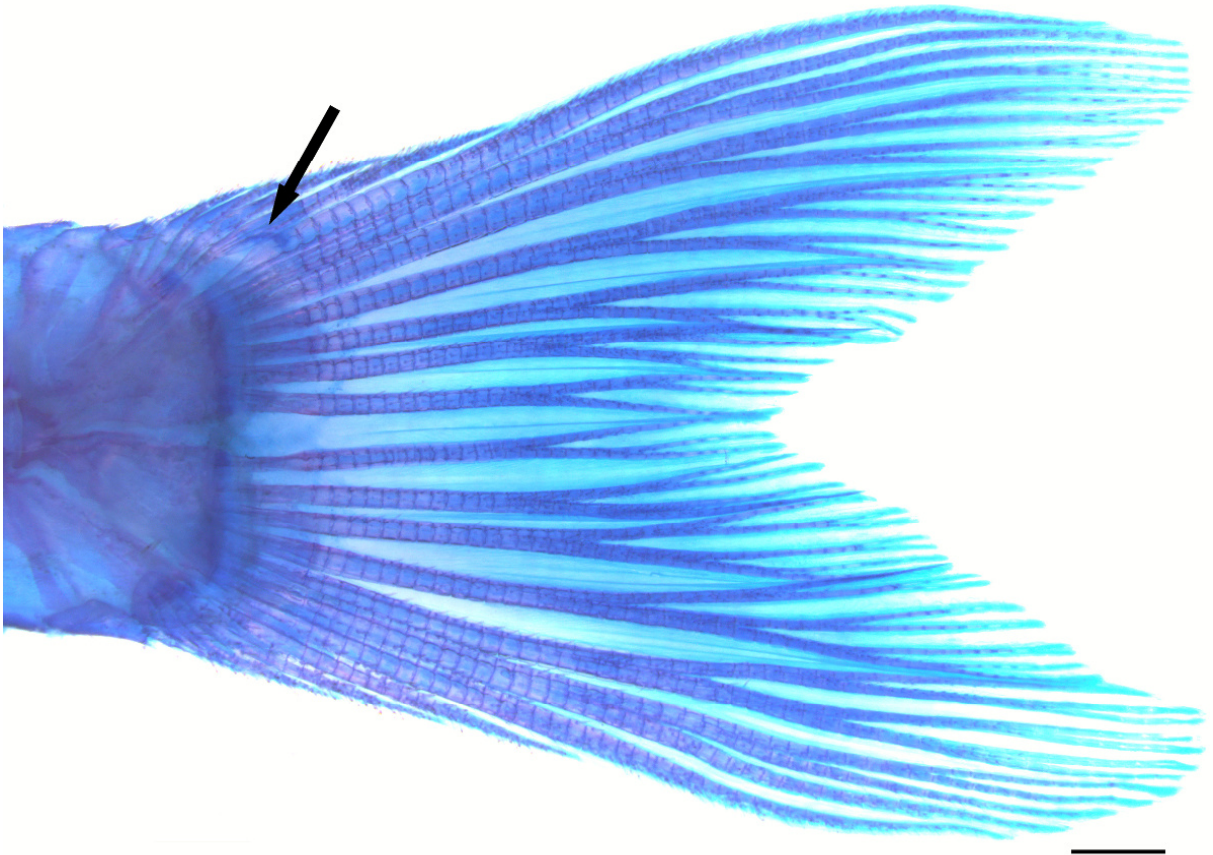


Figure 32.



Figure 33.

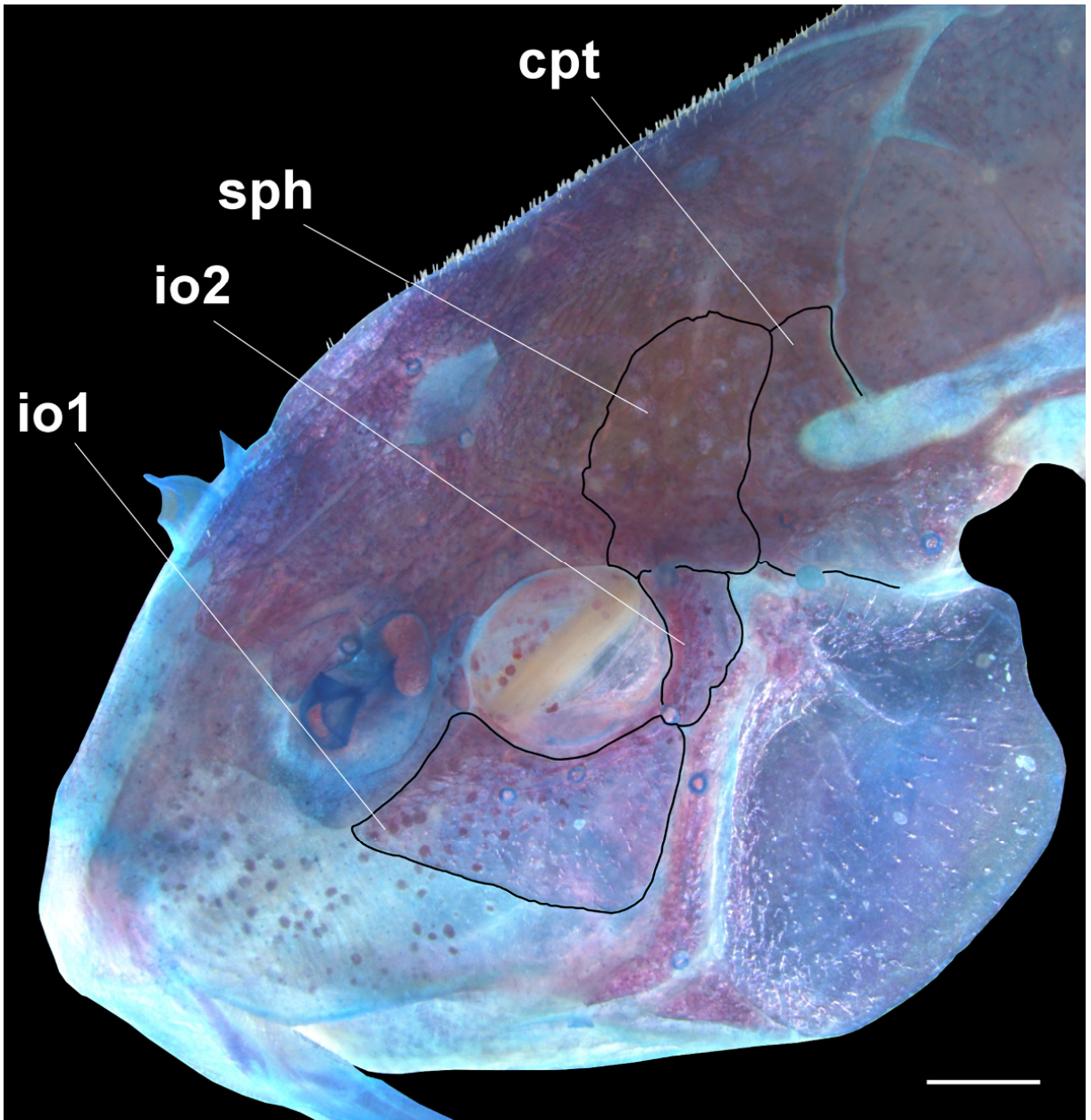


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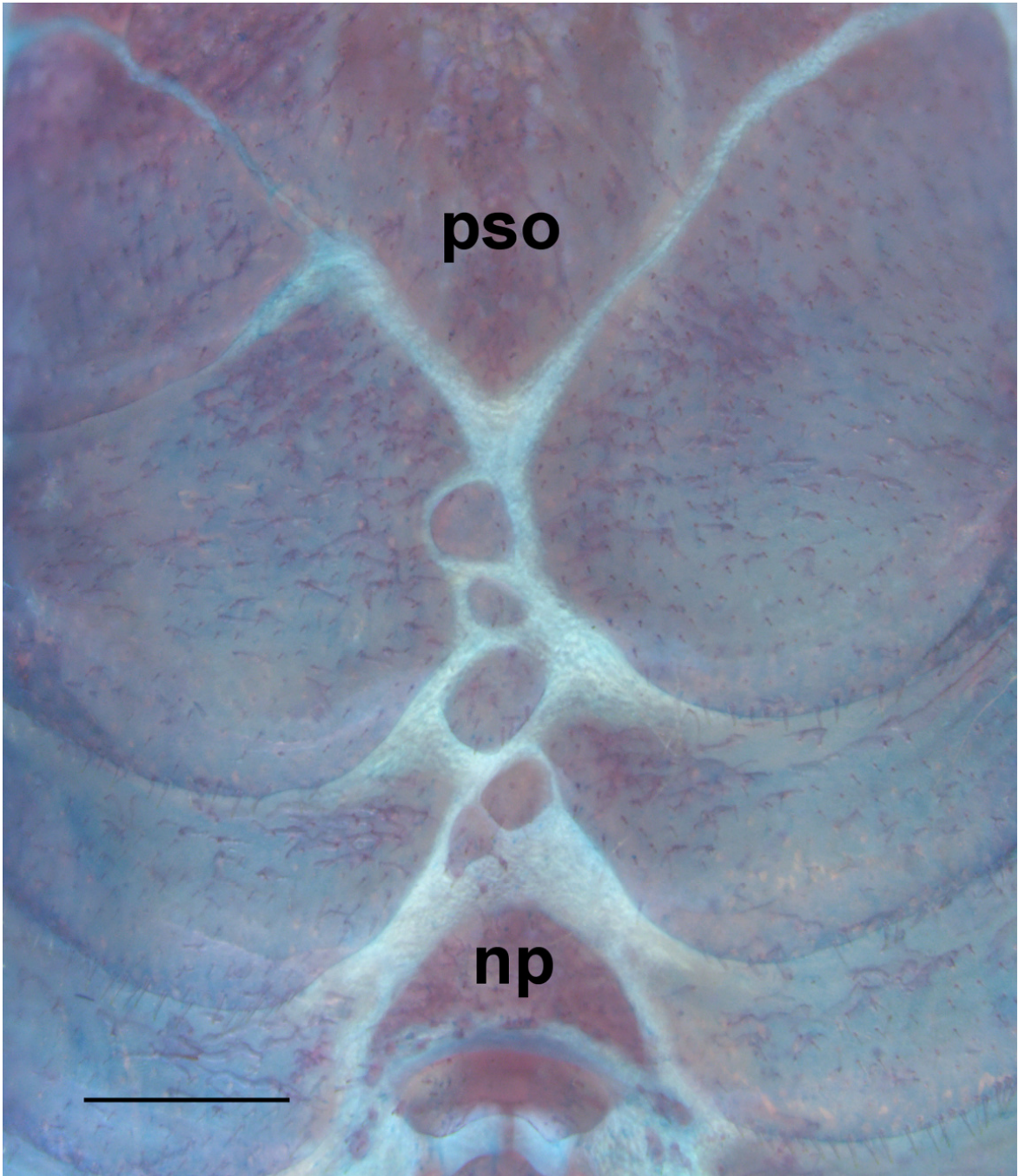


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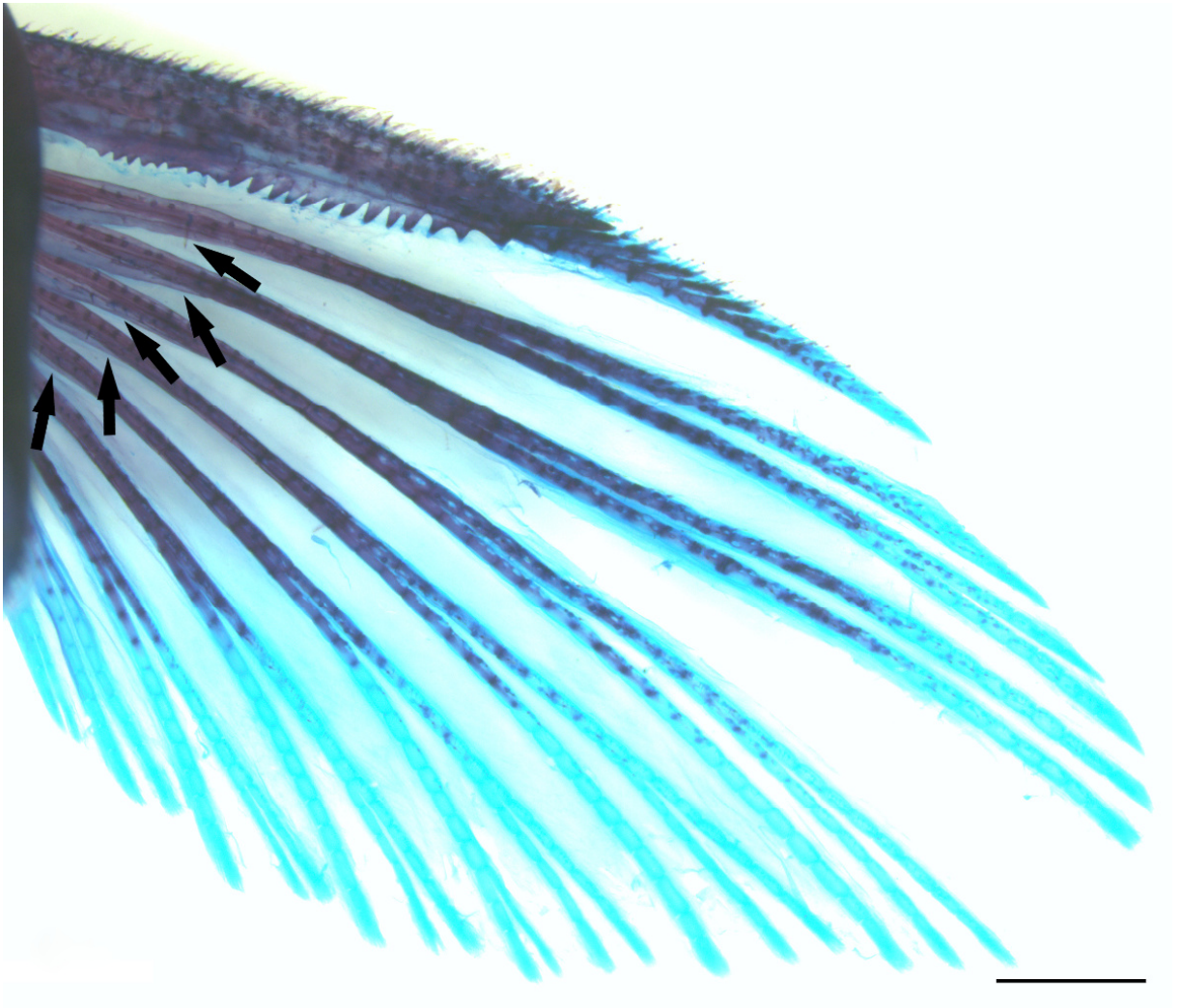


Figure 36.



Figure 37.



Figure 38.



Figure 39.

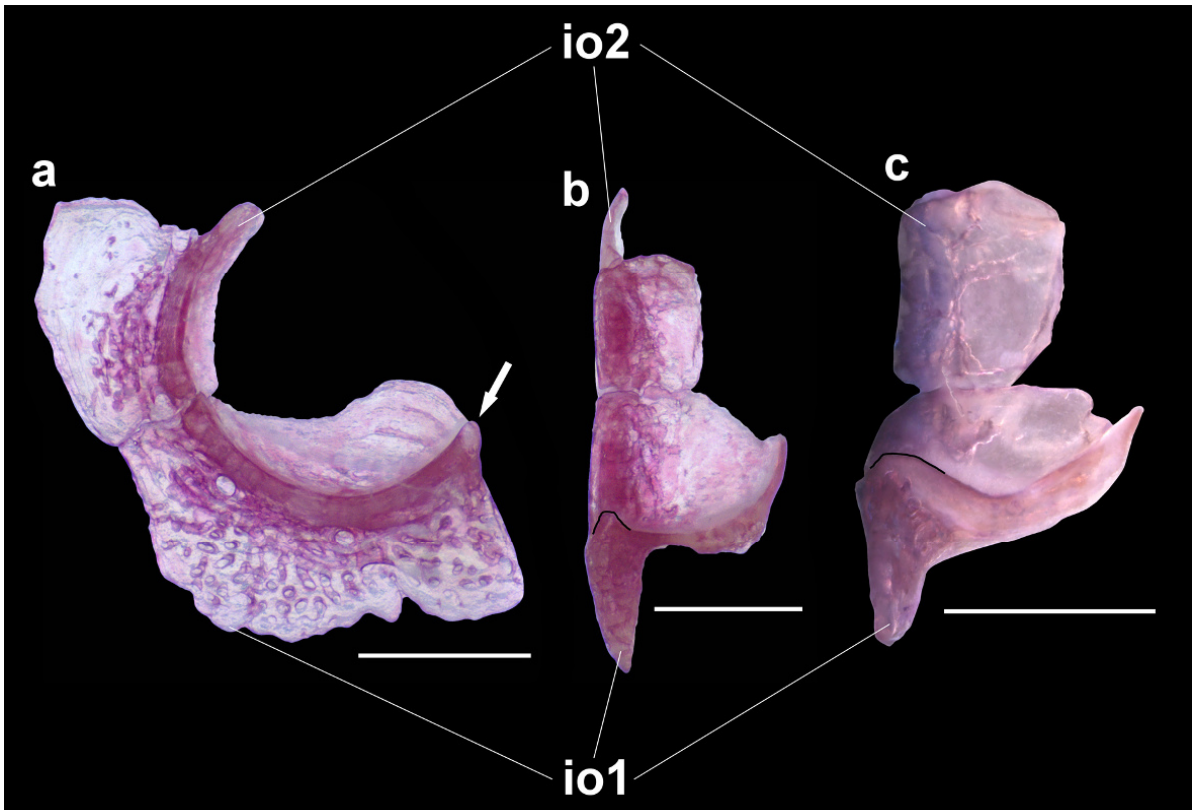


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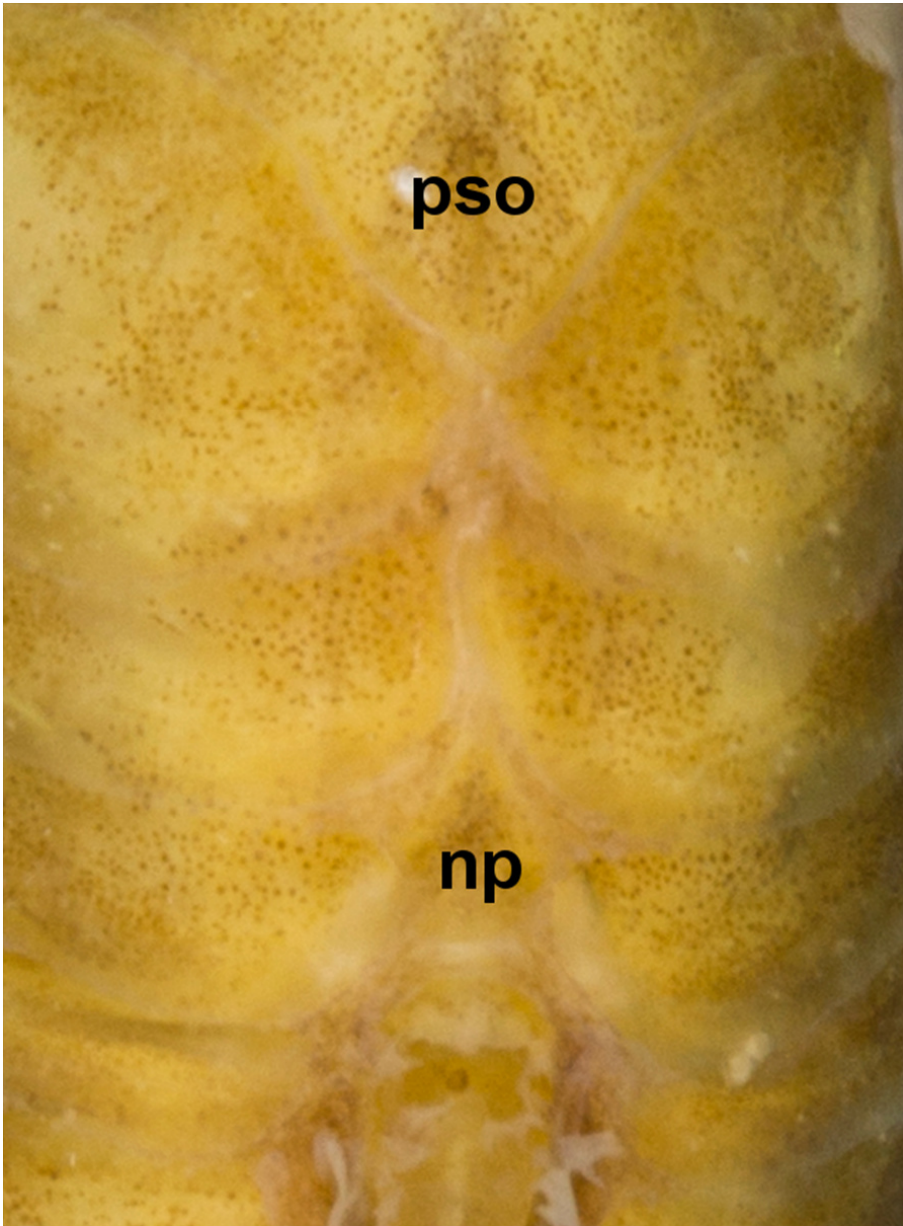


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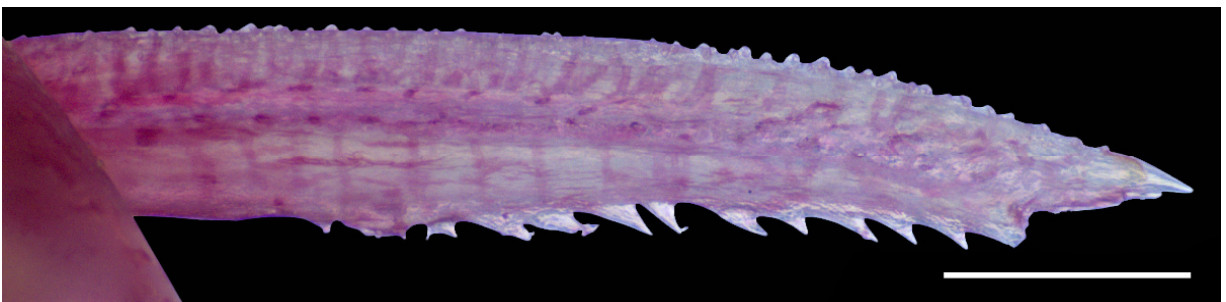


Figure 42.



Figure 43.



Figure 44.

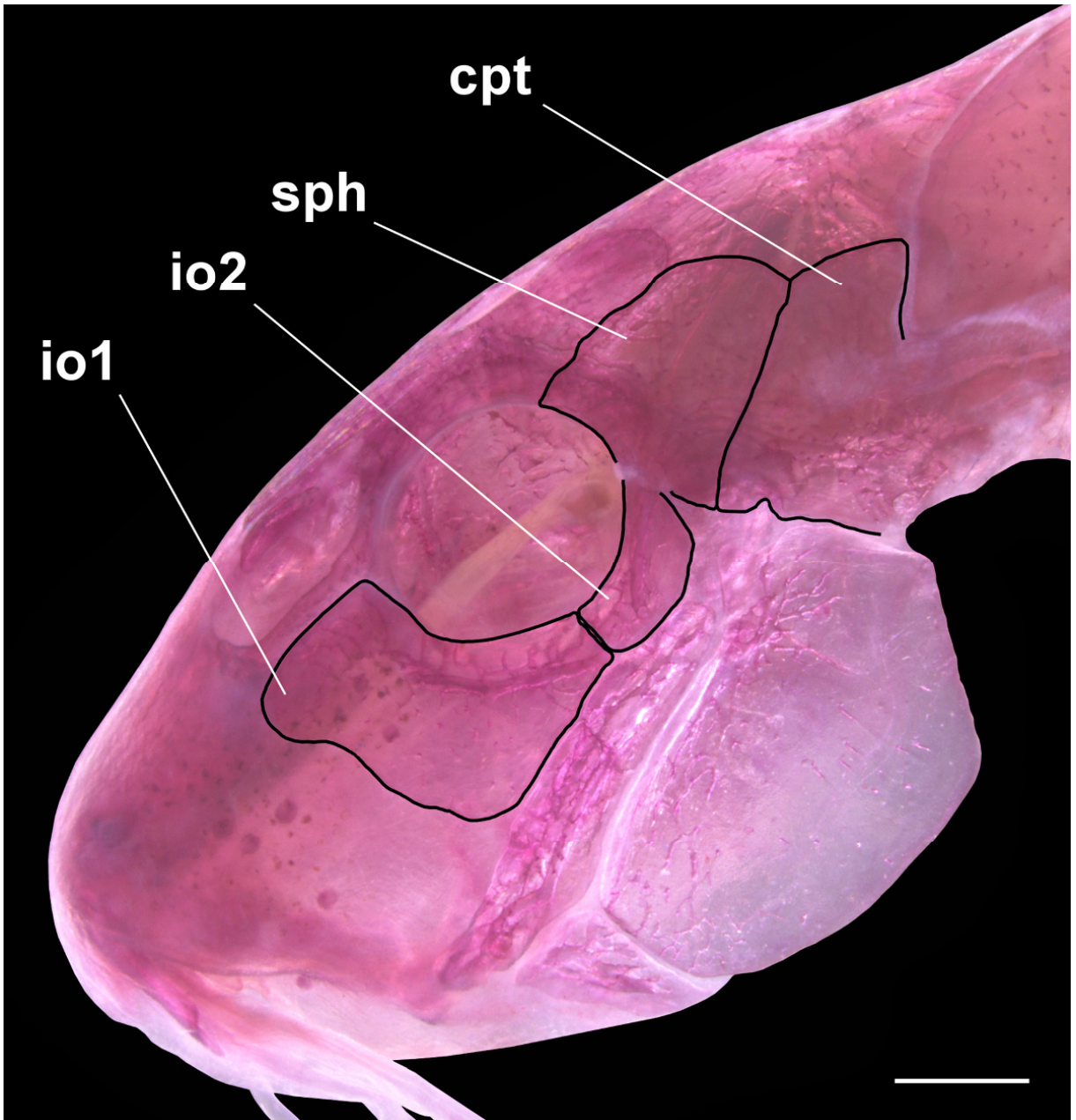


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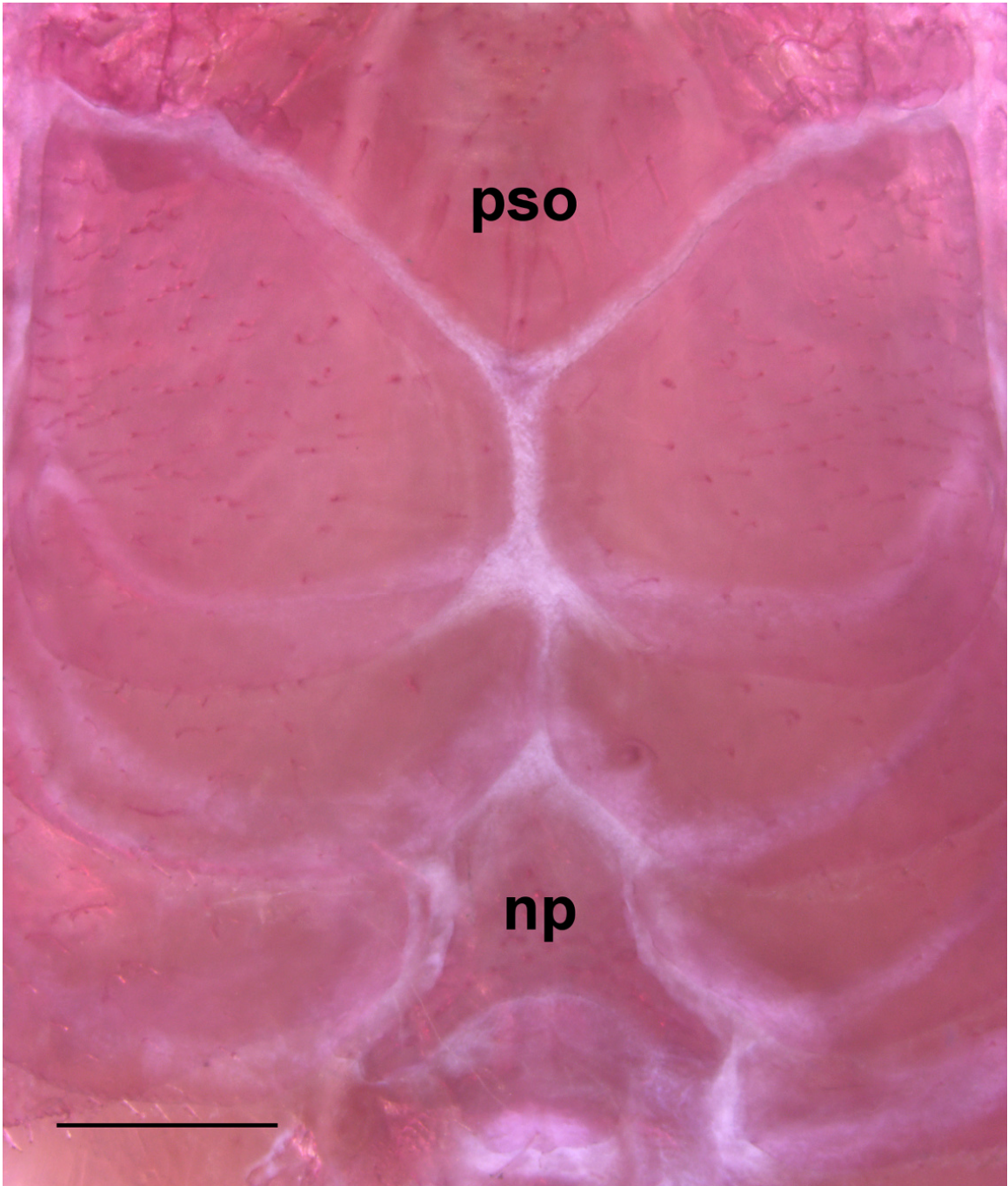


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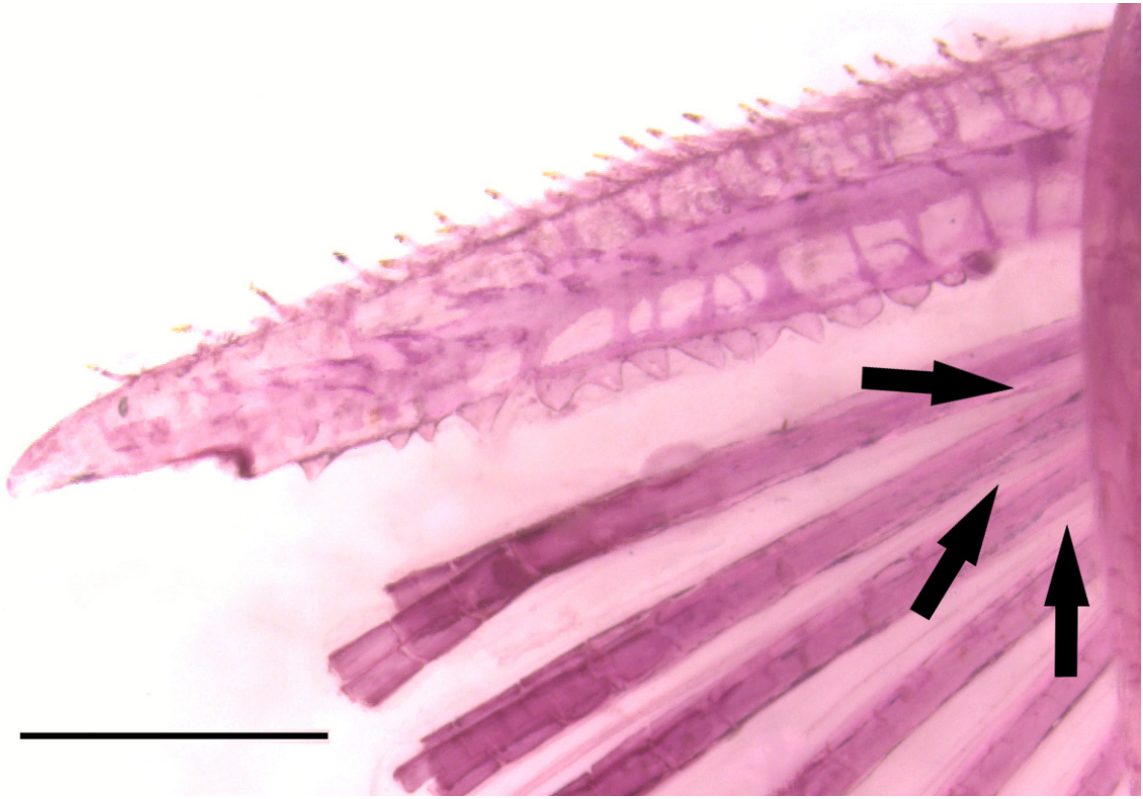


Figure 47.



Figure 48.



Figure 49.

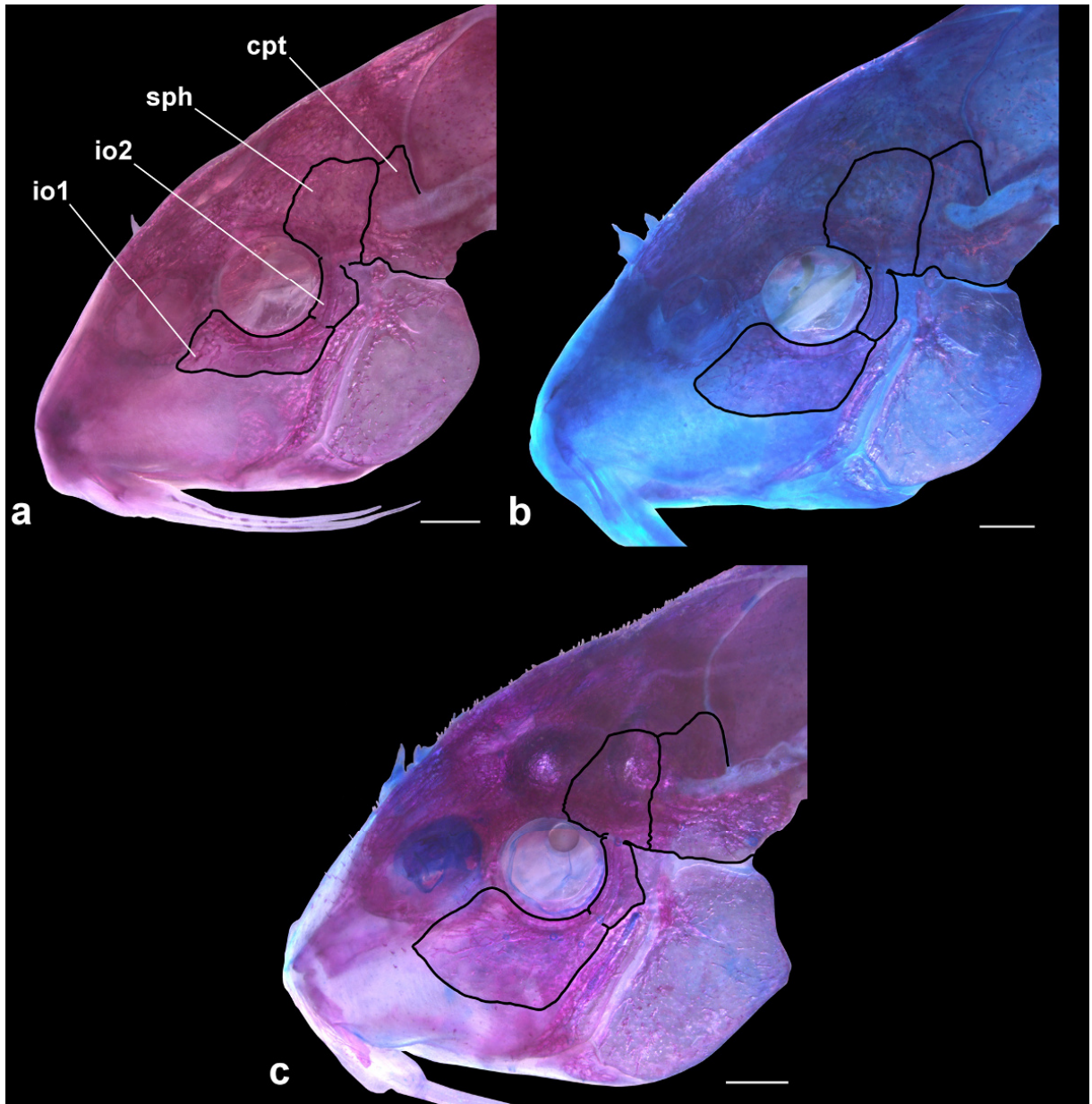


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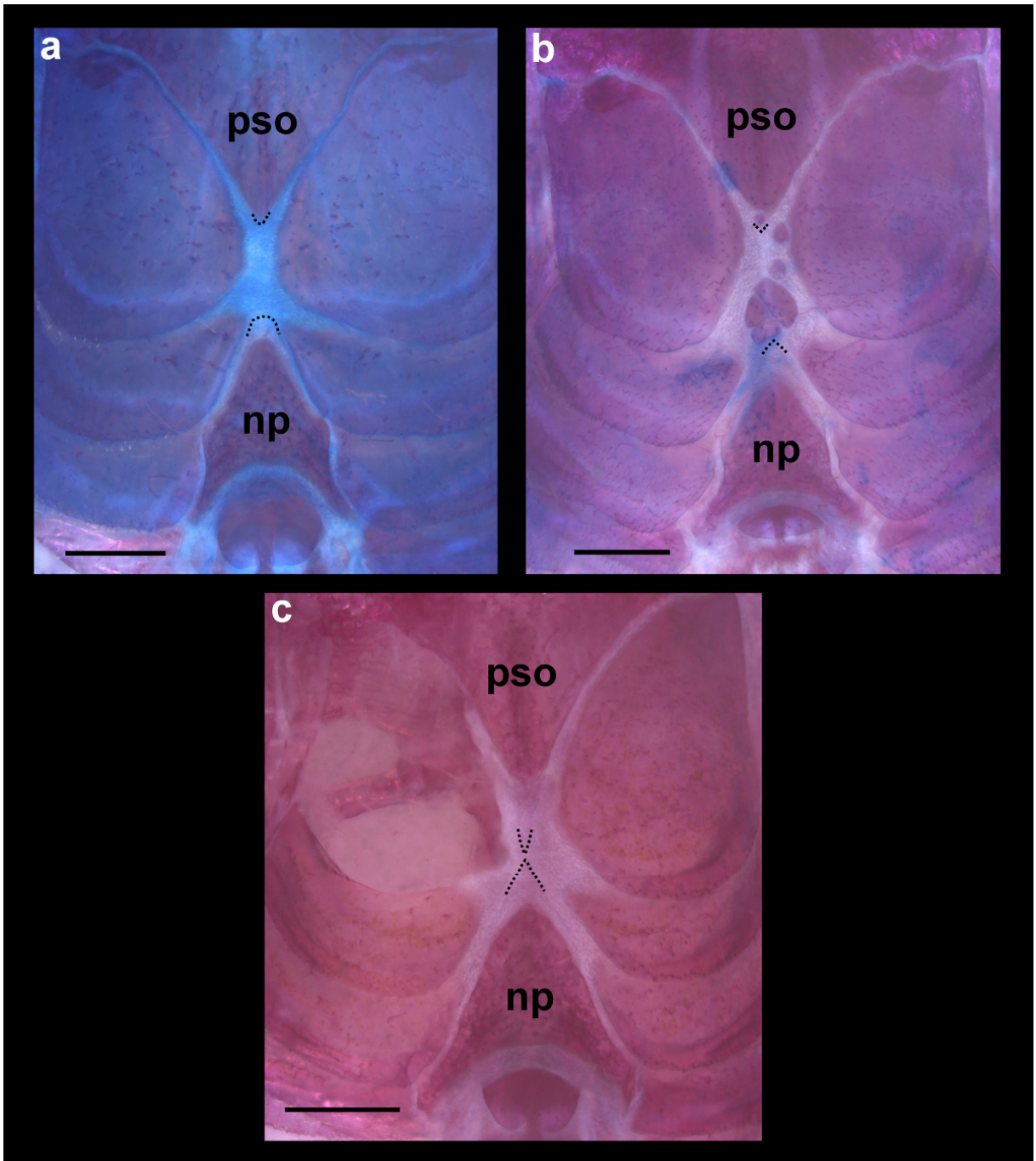


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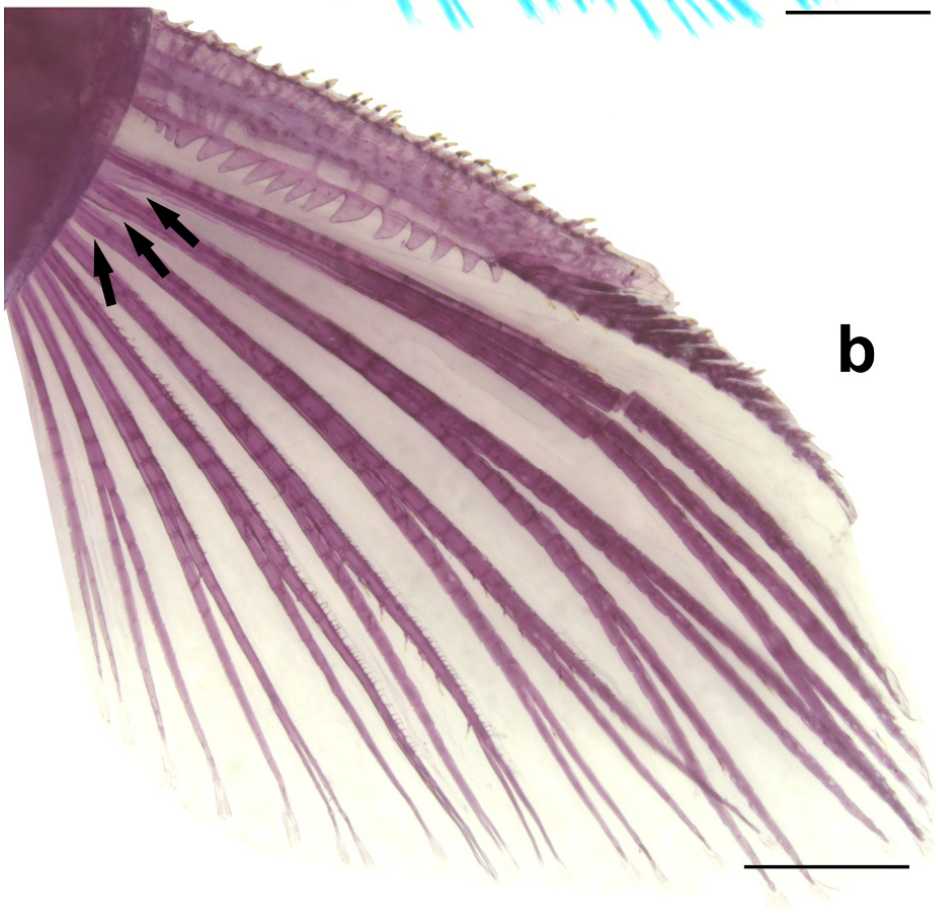
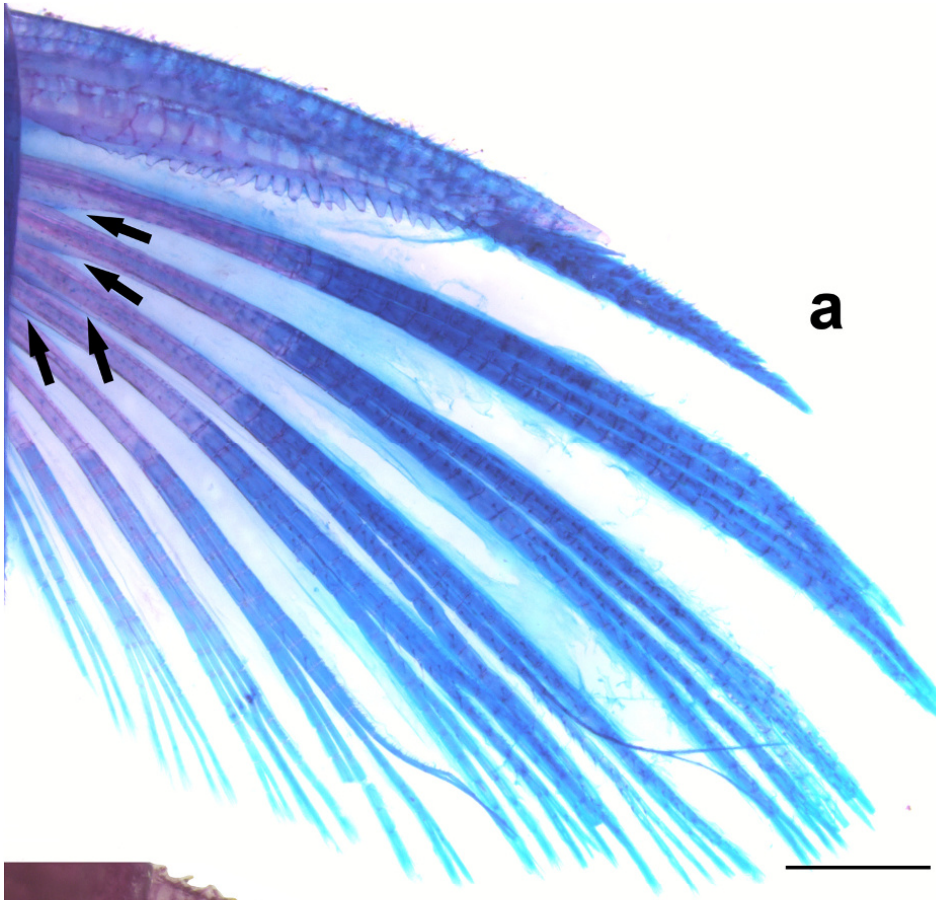


Figure 52.



Figure 53.



Figure 54.



Figure 55.



Figure 56.

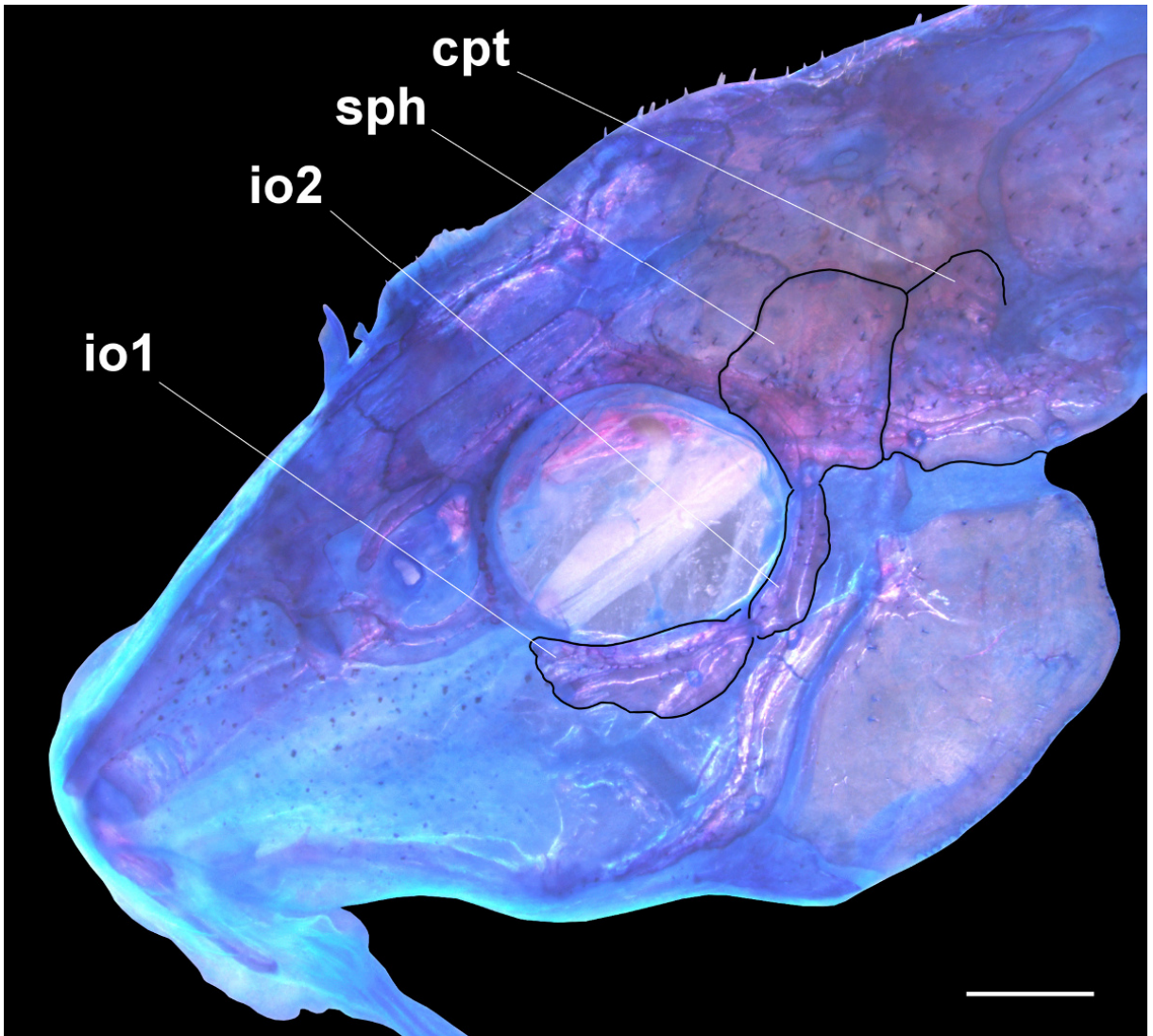


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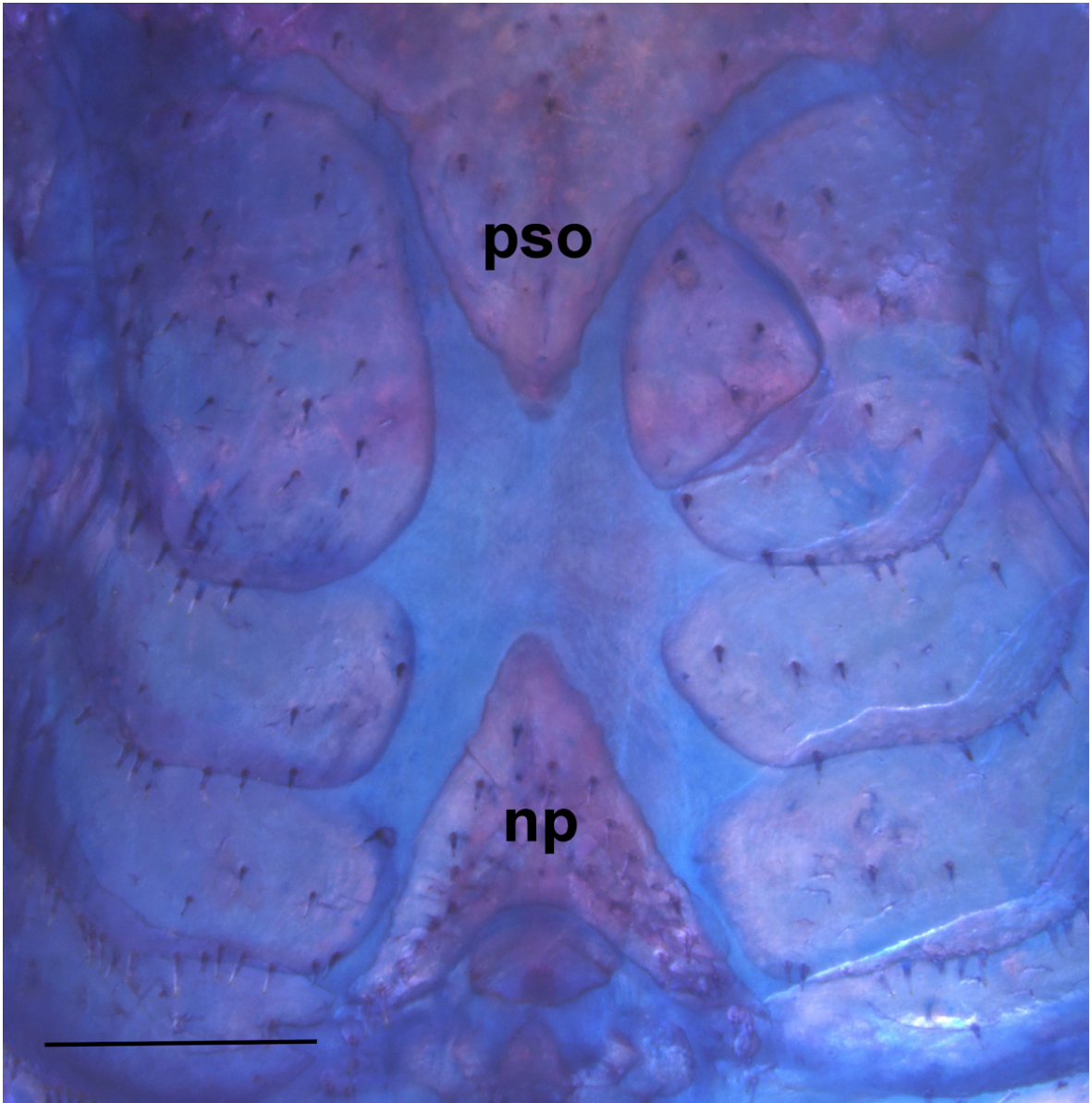


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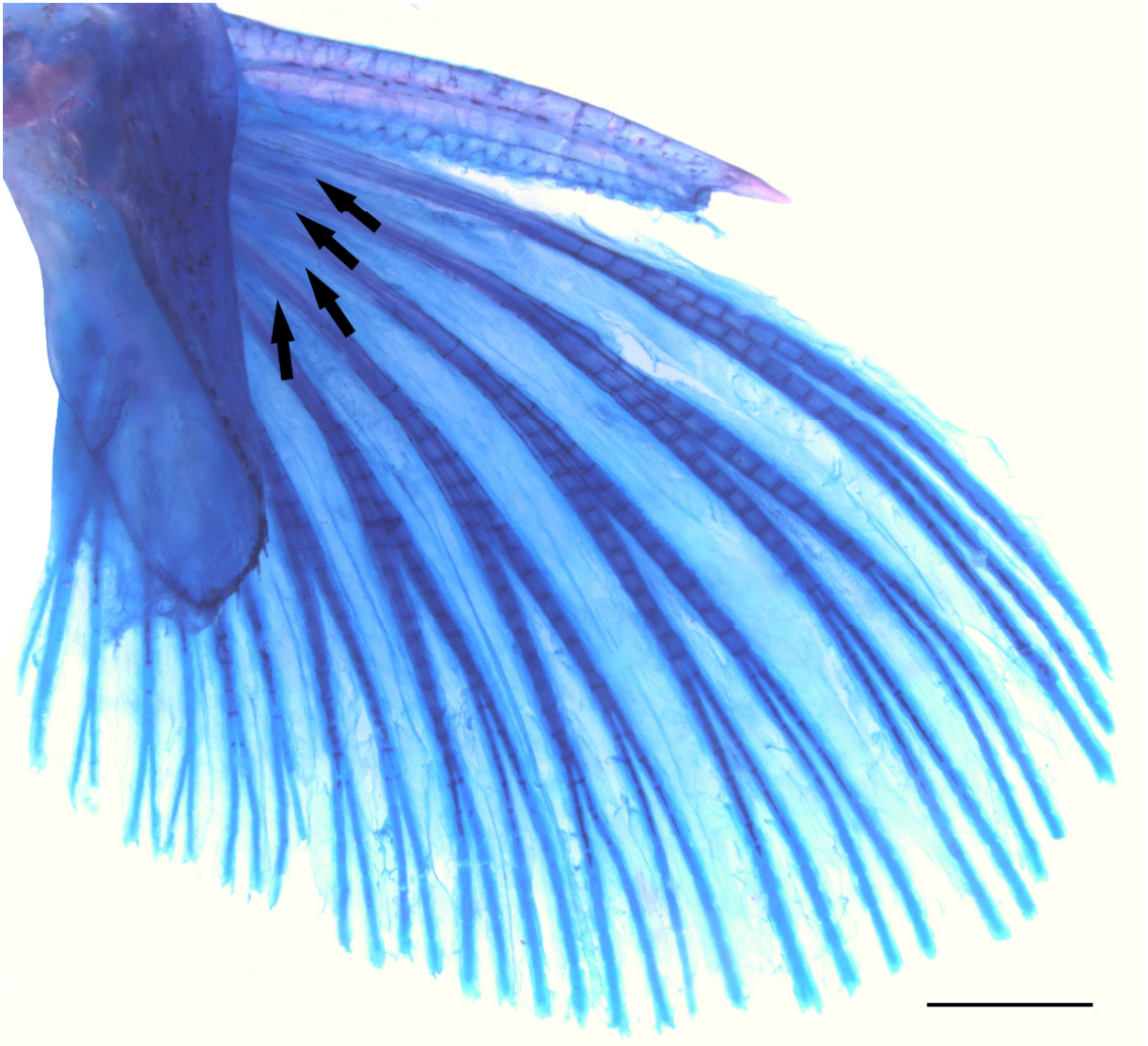


Figure 59.



Figure 60.



Figure 61.

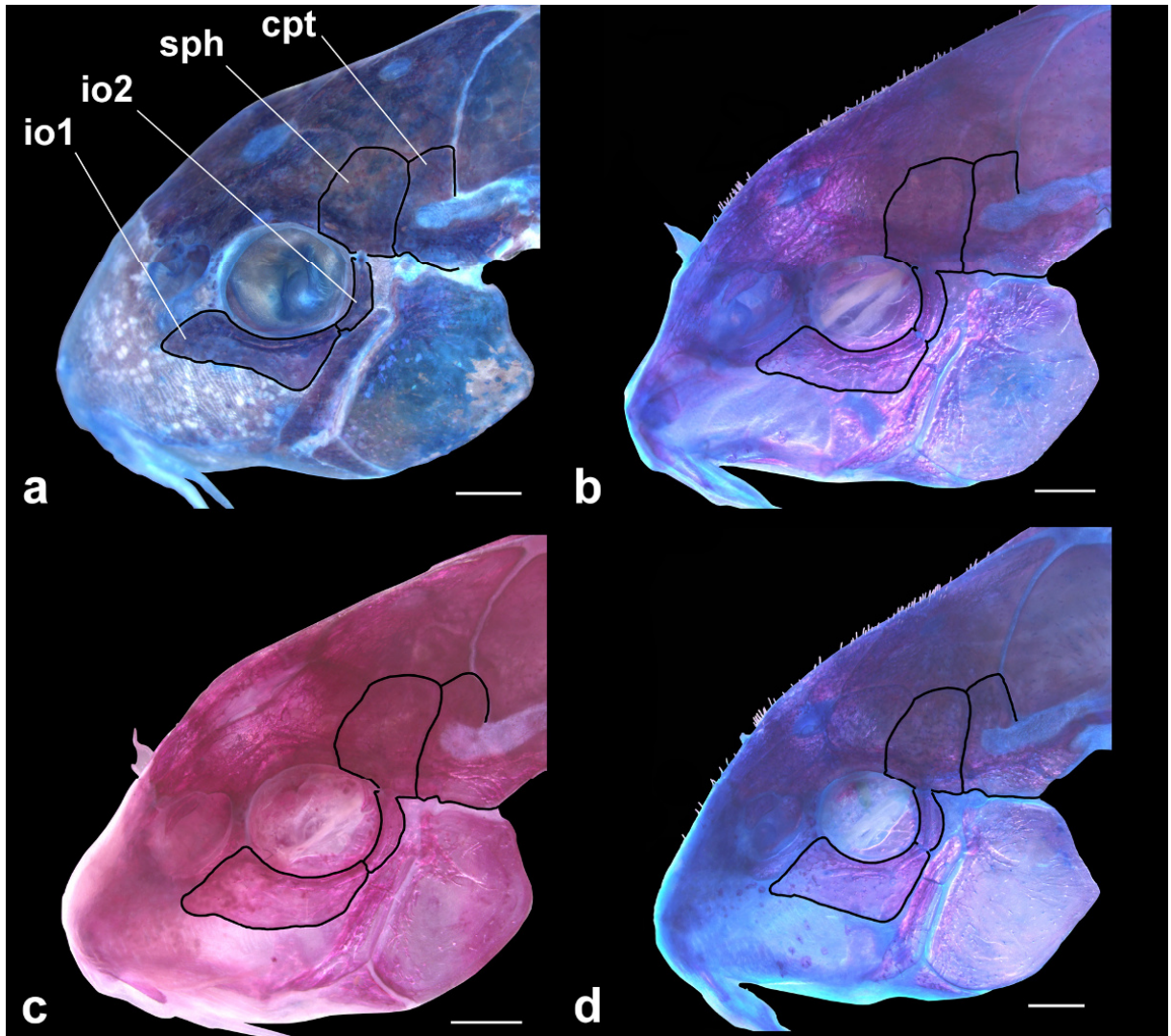


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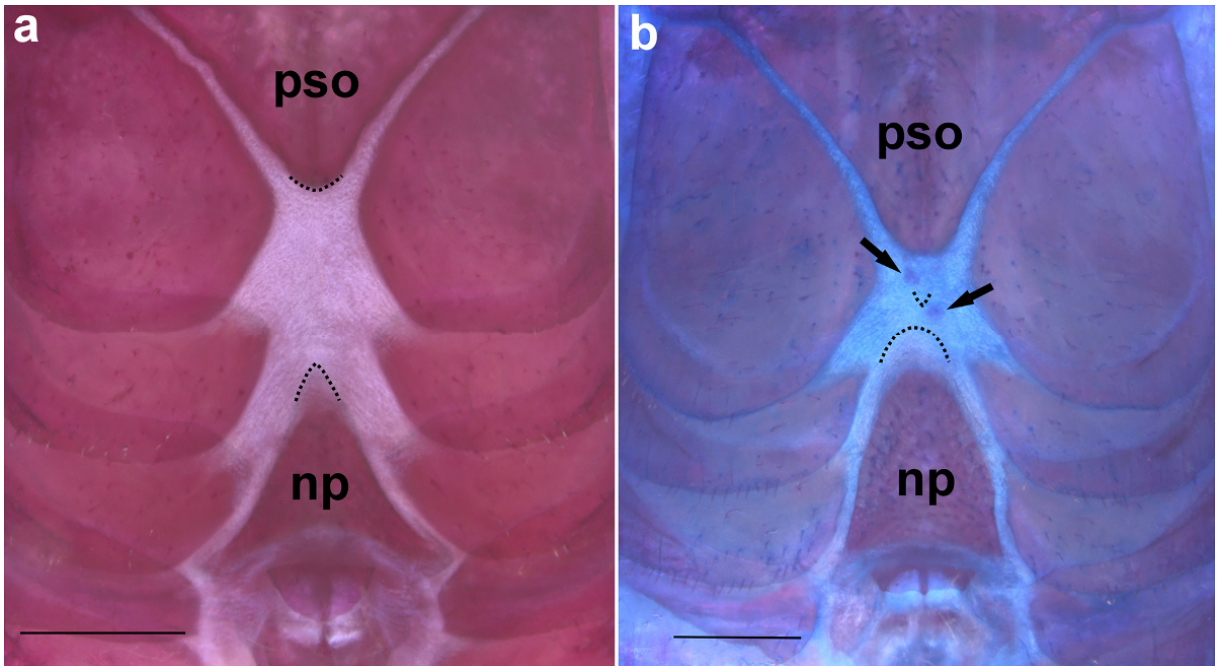


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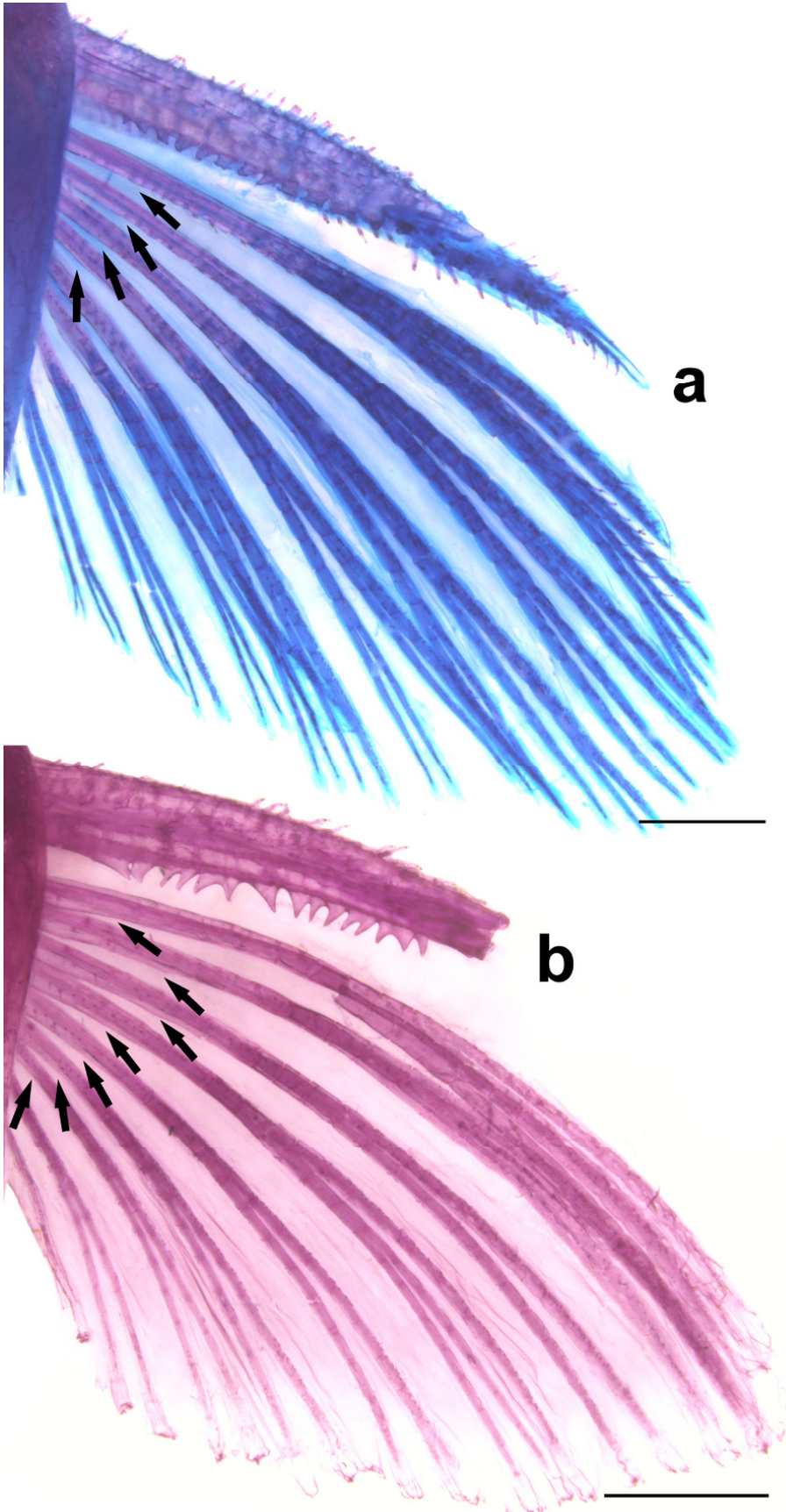


Figure 64.



Figure 65.



Figure 66.

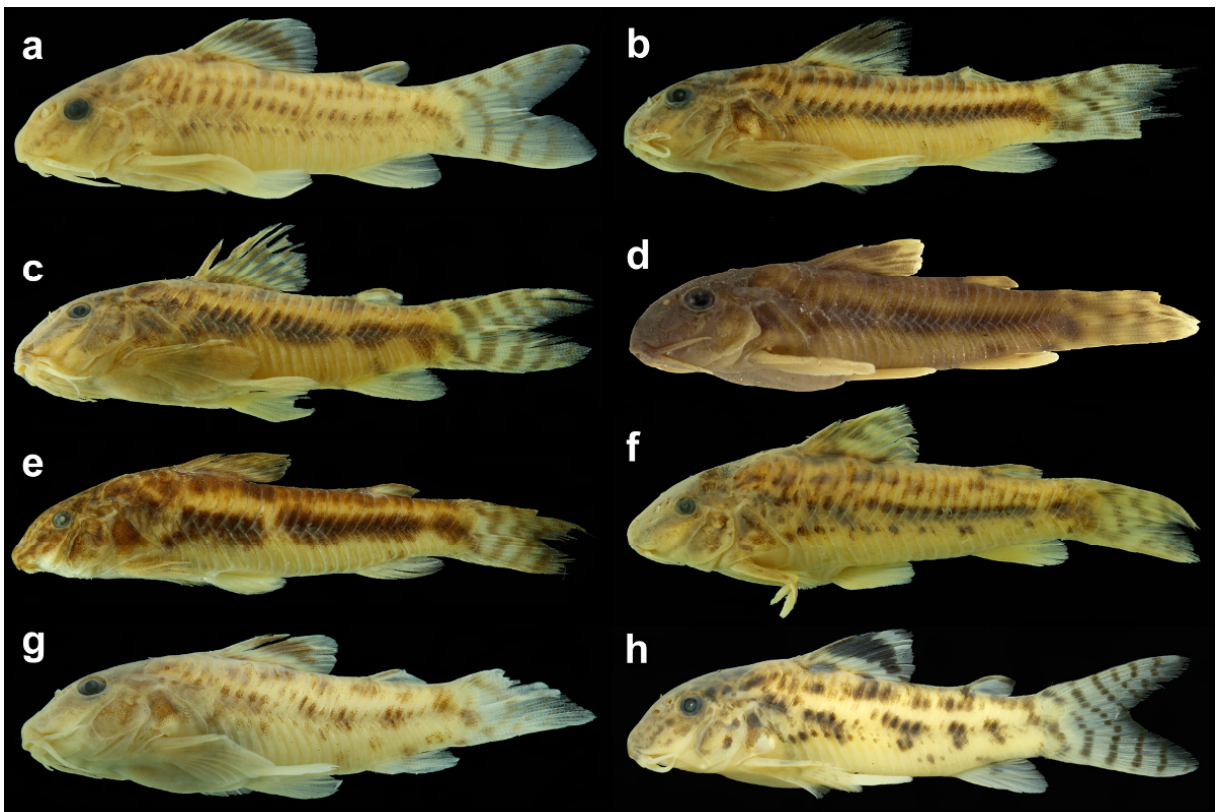


Figure 67.



Figure 68.



Figure 69.



Figure 70.



Figure 71.

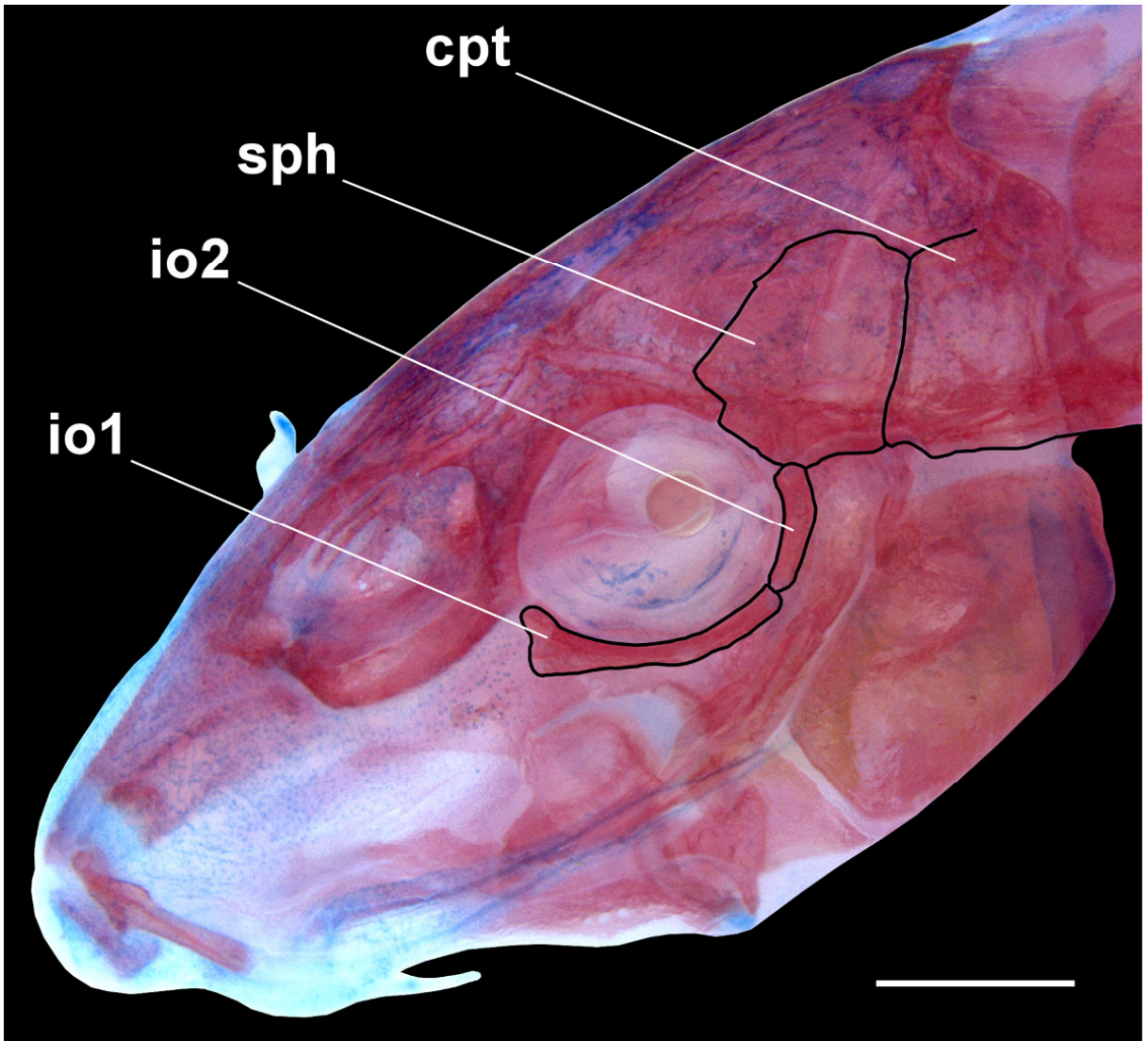


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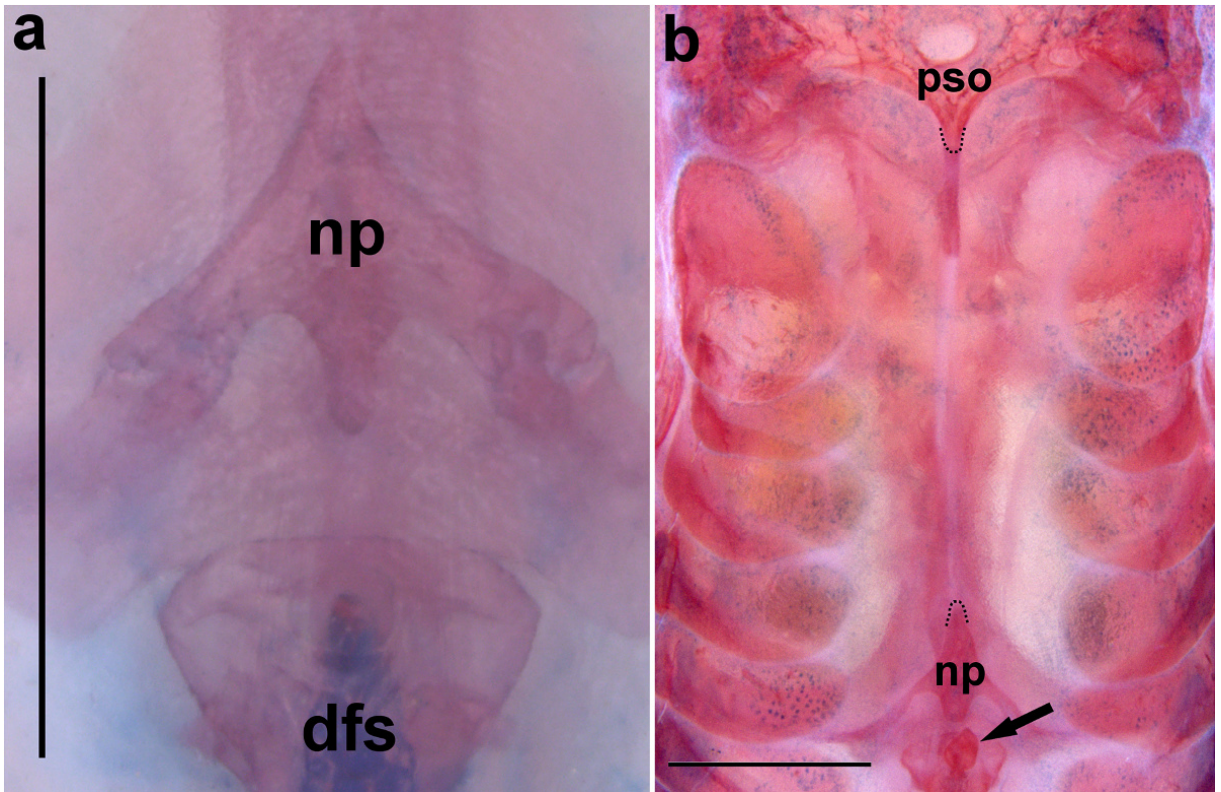


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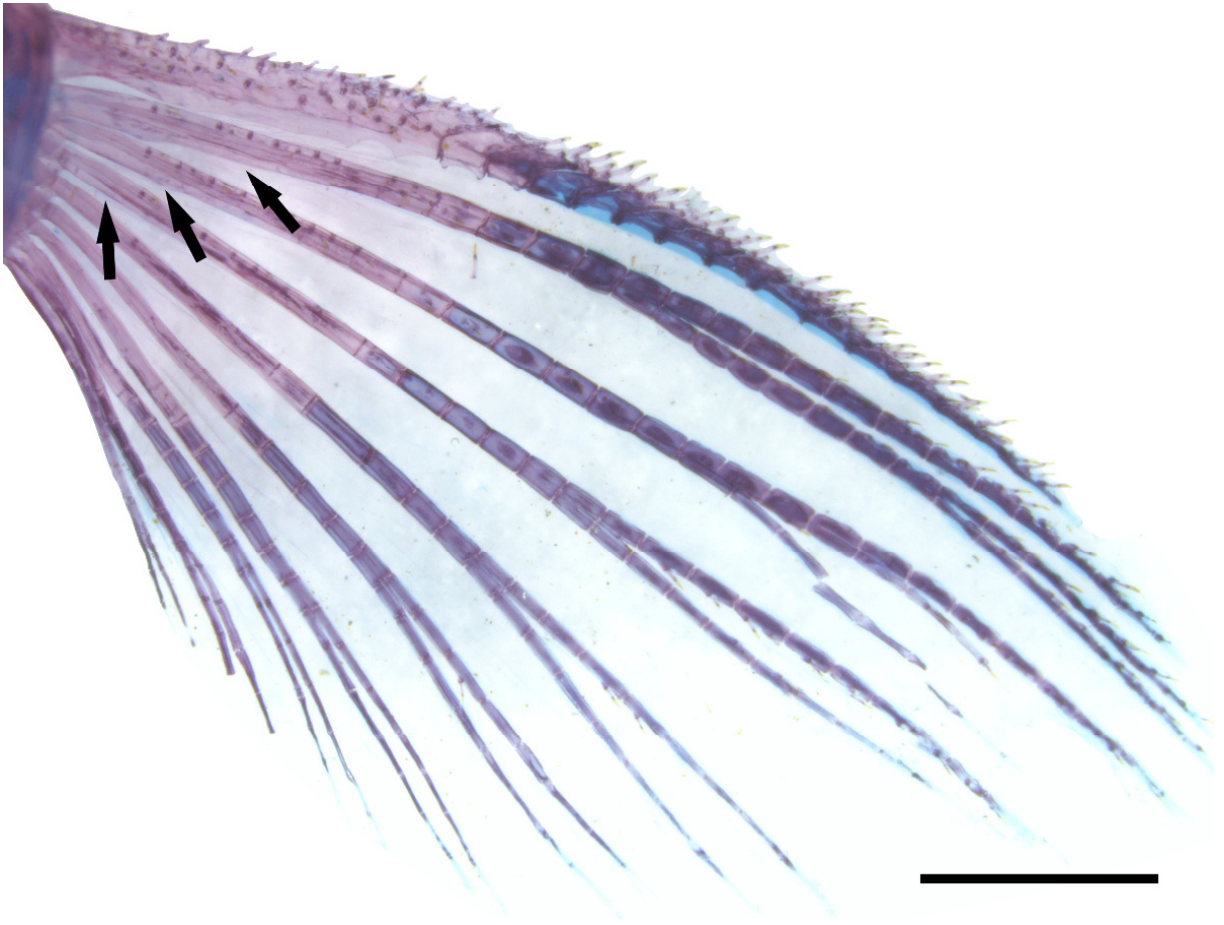


Figure 74.

