

Astyanax xavante, a new species of characid from middle rio Araguaia in the Cerrado region, Central Brazil (Characiformes: Characidae)

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Astyanax xavante is described from a creek of the middle rio Araguaia drainage located in the Cerrado region of the Brazilian Central Plateau. The new species is distinguished from congeners by the combination of pigmentation, morphometric, meristic, morphologic, and tooth features. Ecological notes for *A. xavante* are included.

Astyanax xavante é descrita de um córrego da drenagem do médio rio Araguaia, localizado em área de Cerrado do planalto do Brasil Central. A nova espécie se distingue das demais do gênero pela combinação de caracteres pigmentares, morfométricos, merísticos, morfológicos e dentários. Notas ecológicas para *A. xavante* são incluídas.

Key words: Neotropical fish, Tocantins-Araguaia basin, Teleostei, Piabas, Headwater fish.

Introduction

Our current understanding of the genus *Astyanax* is unsatisfactory. The last complete *Astyanax* revision was conducted by Eigenmann (1921, 1927), and the most recent author to treat the genus as a whole is Géry (1977), who essentially followed Eigenmann. *Astyanax sensu* Eigenmann (1921) is one of the most common genera in the freshwaters of Neotropical basins (Bertaco & Garutti, 2007), and is probably non-monophyletic (Weitzman & Fink, 1983).

At least fifteen *Astyanax* species have been recorded for the large Araguaia-Tocantins basin. Five species have type localities in this basin: *A. argyrimarginatus* Garutti, 1999 (córrego Jaraguá, rio Araguaia tributary, Aragarças, Goiás), *A. elachylepis* Bertaco & Lucinda, 2005 (ribeirão Arara, about 500 m from the mouth of rio Maranhão at Rosariana, Niquelândia, Goiás), *A. goyacensis* Eigenmann (rio Vermelho, rio Araguaia tributary, Goiás), *A. kullanderi* Costa, 1995 (small tributary of rio Perdidos, rio das Mortes drainage, Primavera do Leste, Mato Grosso), and *A. unitaeniatus* Garutti, 1998 (ribeirão Macambira, rio Paranã drainage, Iaciara, Goiás).

Two other *Astyanax* species were described from the Araguaia-Tocantins and adjacent drainages: *A. asuncionensis* Géry, 1972 (= *A. bimaculatus paraguayensis* Eigenmann, 1921), from the Araguaia and Paraguay basins, and *A. novae* Eigenmann from Sono (Tocantins drainage) and Sapão (upper

rio Preto, rio Grande tributary, São Francisco drainage) rivers. Recent reference to *A. asuncionensis* from the middle rio Araguaia basin can be found in Garutti & Langeani (2009). *Astyanax novae* occurs in the semi-arid areas of the states of Tocantins, Maranhão and Bahia, in the headwaters of rio do Sono sub-basin and tributaries of the rio Tocantins (rio Tocantins basin), and of the rio Preto sub-basin (rio São Francisco basin). Numerous collections of this species have recently been made and deposited in the Museu de Zoologia da Universidade de São Paulo (MZUSP).

Four species have their type localities distant from the Araguaia-Tocantins basin, which raises doubts about the correct identification and, evidently, the occurrence of these species in this basin. All these species are considered a species complex (Garutti & Britski, 1997; Bertaco & Lucena, 2006; Melo & Buckup, 2006). The first one is *A. fasciatus* (Cuvier, 1819) (Melo *et al.*, 2004; Santos *et al.*, 2004) whose type locality is located in the rio São Francisco basin (Garutti & Britski, 2000) (type locality mentioned originally: “Brésil”), and whose distribution should be restricted to the rio São Francisco basin (Melo & Buckup, 2006). The senior author examined (December 2005) the collection used by Melo *et al.* (2004) from the middle rio Araguaia in the Cerrado region, and did not find any specimen that could be identified as *A. fasciatus*. The depiction of *A. fasciatus* in Santos *et al.* (2004) shows a conspicuous rounded black humeral spot, and so, it does not

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correspond to *A. fasciatus* (Cuvier) [vs. a faint vertical humeral spot (Eigenmann, 1921)]. Therefore, these references suggest that they may have been incorrect identifications. The second species is *A. bimaculatus* (Linnaeus, 1758) (e.g., Lowe-McConnell, 1991). The type locality originally mentioned is “América Meridionali,” but according to Garutti & Britski (2000), it should be limited to the Suriname drainages. Its occurrence in the rio Araguaia-Tocantins basin has not been demonstrated, although specimens of the *Astyanax bimaculatus* species complex are frequent and abundant in this system (Garutti, 1995). The third species is *A. abramis* (Jenyns) mentioned by Santos *et al.* (2004), which according to Garutti (1998) belongs to the *Astyanax bimaculatus* species complex. However, the data supplied by those authors (presence of a maxillary tooth and 39 scales on lateral line) do not refer to the *A. abramis*, but to another probably undescribed species of the *Astyanax bimaculatus* complex. *Astyanax abramis* has no maxillary tooth, and a higher number of scales on the lateral line (42-49 [Britski *et al.*, 2007]; 42-47 [Garutti, 1995]). The *A. abramis* type locality is in Rosario, Argentina. Finally, the fourth species is *A. scabripinnis*, described by Souza & Moreira-Filho (1995) as occurring in the córrego Avoadeira (Barra do Garças, Mato Grosso), which is the same creek where the current specimens under investigation have been acquired. The *A. scabripinnis* type locality is Rio de Janeiro. Therefore, it is a mistaken identification as will be demonstrated below.

The last four remaining species from the Araguaia-Tocantins basin were mentioned by Lowe-McConnell (1991): *Astyanax* cf. *gracilior* Eigenmann, 1908, *A. guianensis* Eigenmann, 1909, *A. scintillans* Myers, 1928, and *A. symmetricus* Eigenmann, 1908. None of these species can be confirmed by this study of the middle rio Araguaia. Regarding the Araguaia-Tocantins basin, there are also references made to new species (Garutti, 1995) and unidentified *Astyanax* species (e.g., Melo *et al.*, 2004).

In this paper, a new species of *Astyanax* is described, which shares some features with species of the *Astyanax scabripinnis* complex (Bertaco & Lucena, 2006) but does not meet all the requirements for its inclusion in this complex.

Material and Methods

Counts and measurements followed Fink & Weitzman (1974) and Garutti & Britski (1997). Measurements were taken point to point with a caliper on the left side of specimens (precision of 0.1 mm). All measurements other than standard length (SL), head length (HL), and body depth (BD) are expressed as percent of SL, HL, and BD. Cleared and counterstained specimens (cs) were prepared according to Taylor & Van Dyke (1985). Vertebra counts include the four vertebrae of the Weberian apparatus, and the compound caudal centrum is counted as one. Absolute frequency of the counts of vertebrae, supraneurals, gill-rakers on the first arch, and procurrent caudal-fin rays are shown between parentheses. Values of the holotype are indicated by an

asterisk. The comparative data used come from the original descriptions, except where indicated or when examined.

Specimens examined are housed in the British Museum of Natural History, London (BMNH), Coleção do Laboratório de Ictiologia of Campus Universitário do Araguaia, Universidade Federal de Mato Grosso, Pontal do Araguaia, MT (ICLMA), Departamento de Zoologia e Botânica da Universidade Estadual Paulista, São José do Rio Preto, SP (DZSJRP), Field Museum of Natural History, Chicago (FMNH) Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS (MCP), Museu de Zoologia da Universidade de São Paulo, São Paulo, SP (MZUSP), and Museum of Comparative Zoology, Cambridge (MCZ). The samples were collected with permission from the Instituto Brasileiro do Meio Ambiente e dos Recursos Renováveis - IBAMA (068/2005-DIFAP).

Astyanax xavante, new species

Fig. 1

Astyanax scabripinnis (not Jenyns, 1842), Souza & Moreira-Filho, 1995 (Brazil, Mato Grosso, Barra do Garças; genetic features).

Holotype. MZUSP 100375, 57.3 mm SL, Brazil, Mato Grosso, Barra do Garças, creek tributary to the córrego Avoadeira, inside the Parque Estadual da Serra Azul, approx. 15°53'S 52°15'W, 1 Feb 2005, V. Garutti & P. C. Venere.

Paratypes. MCP 43325, 45, 22.6-58.2 mm SL and MZUSP 100376, 102 (3 cs), 18.8-59.6 mm SL, same data as for the holotype.

Non-type specimens. All from Brazil, Mato Grosso, Barra do Garças, córrego Avoadeira, approx. 15°53'S 52°15'W. DZSJRP 11287, 67, 26.6-56.6 mm SL, 5 Apr 2005, V. Garutti *et al.*; ICLMA 503, 52, 25.0-57.2 mm SL, 1 Feb 2005, V. Garutti *et al.*

Diagnosis. From the species assigned to the Araguaia-Tocantins basin, *Astyanax xavante* differs readily by having humeral spot vertically elongated vs. horizontally oval in *A. argyrimarginatus*, *A. asuncionensis*, *A. goyacensis*, *A. kullanderi*, *A. novae*, *A. unitaeniatus*, and other undescribed forms of the *Astyanax bimaculatus* species complex; fewer lateral-line scales, 34-37 vs. more than 48 in *A. elachylepis* and *A. symmetricus*; larger body depth, 35.5-40.2 vs. 25.0-28.6% of SL in *A. gracilior*; more anal-fin rays, 23-26 vs. 18-19 in *A. scintillans*; and fewer maxillary teeth, 1-3 vs. 4-7 in *A. guianensis*. *Astyanax xavante* is distinguished from all other congeners by the following combination of characters: two vertical, brown humeral spots, a brown stripe on the flank, a black spot on the middle caudal-fin rays, 19 to 23 branched anal-fin rays, 34 to 37 perforated scales on lateral line, larger body depth (35.5-40.2% of SL) in about two to three scales ahead of dorsal-fin origin, head length 28.4-31.2% of SL, head not massive, interorbital width 34.5-39.4% of HL, snout not abruptly tapered, distance from snout to origin of dorsal fin



Fig. 1. *Astyanax xavante*, MZUSP 100375, 57.3 mm SL, holotype, from creek tributary of the córrego Avoadeira, rio Araguaia basin (approx. 15°53'S 52°15'W), Barra do Garças, Mato Grosso, Brazil.

50.0-56.0% of SL, one to three maxillary teeth, five tetra- to heptacuspitate premaxillary inner row teeth, four, large, penta- to heptacuspitate, and four to nine, small uni-, bi-, tri- or pentacuspitate, dentary teeth, anal-fin origin on vertical through posterior third of dorsal-fin base, and fin ray hooks in mature males absent.

Description. Morphometric and meristic data of holotype and paratypes presented in Table 1. Larger specimen 59.6 mm SL. Body compressed and elongate; larger depth in about two to three scales ahead of dorsal-fin origin. Preventral and predorsal areas rounded. Dorsal and ventral body portions unequal, first shallower when verified by imaginary horizontal line passing through buccal opening. Dorsal profile straight between snout and occipital process; slightly convex from this point to base of dorsal-fin origin; straight from there to caudal-fin, slightly concave at limits of dorsal and adipose fins. Ventral profile smoothly convex from snout up to slightly behind pectoral-fin origin; straight from that point to anal-fin origin; straight at base of anal fin and straight from there to caudal fin.

Mouth terminal and horizontal. Snout smaller than eye diameter. Upper jaw slightly longer than lower jaw. Upper jaw larger than orbital diameter.

Dorsal-fin origin at middle or posterior to middle of standard length; when adpressed its distal extremity reaches fourth scale anterior to adipose-fin origin; distal border smoothly rounded; ii,9 rays. Caudal fin naked and forked, with symmetric or slightly asymmetric lobes with lower lobe somewhat larger; extremities slightly round; i,17,i rays. Distal pectoral border smoothly rounded; distal extremity surpasses pelvic fin origin in larger specimens (larger than about 40 mm SL), but not in smallest specimens; i,10-12* rays. Pelvic-fin origin anterior to vertical line through dorsal-fin origin; distal border smoothly rounded; tip not reaching anal-fin origin; i,6* - i,7 rays. Anal fin origin on vertical through posterior third of dorsal fin base;

Table 1. Morphometric and meristic data of the holotype and paratypes of *Astyanax xavante* (N: number of specimens; M: mean; SD: standard deviation).

Character	N	M±SD	range	holotype
Standard length (mm)	25	46.6	33.6-59.6	57.3
Head length (mm)	25	14.0±2.4	10.0-19.8	17.1
Body depth (mm)	25	17.5±2.7	12.1-22.7	21.2
Percents of standard length				
Head length	25	29.8±0.8	28.4-31.2	29.8
Body depth	25	37.7±1.3	35.5-40.2	37.0
Caudal peduncle depth	25	12.7±0.6	12.0-13.8	12.6
Snout to dorsal-fin origin	25	53.3±1.3	50.0-56.0	53.1
Snout to anal-fin origin	25	65.4±1.3	62.3-67.7	66.5
Distance dorsal-pectoral fins	25	41.8±1.3	39.4-44.7	43.1
Distance dorsal-anal fins	25	38.2±1.4	35.6-41.3	37.5
Distance anal-adipose fins	25	37.0±1.4	35.0-40.2	35.6
Distance dorsal-adipose fins	25	37.7±1.3	36.0-40.0	36.6
Percents of head length				
Orbital diameter	25	36.7±2.1	31.6-40.0	31.6
Interorbital width	25	36.4±1.3	34.5-39.4	38.6
Head depth	25	98.2±4.2	92.2-106.2	99.4
Upper jaw length	23	46.8±2.5	42.2-50.7	49.7
Snout length	24	26.2±1.8	22.7-30.7	28.2
Percents of body depth				
Caudal peduncle depth	25	33.3±1.6	31.0-36.5	33.9

distal border smoothly convex (usually) or straight in anterior third, and smoothly convex (usually) or smoothly concave posteriorly; iii-v(iv*),19-23(20*) rays (total: 23-26).

Dorsal procurrent rays 12(3); ventral procurrent rays 10(3). Vertebrae 35(1) or 36(2). Gill-rakers on first branchial arch 7+1+10(1), 8+1+9(1), or 8+1+10(1). Supraneurals 4(2) or 5(1).

Scales cycloid, not very thick. Lateral line complete, 34-37(36*) perforated scales. Transverse rows of scales 12-14(13*); above lateral line 6-7* rows; below lateral line 5*-6 rows. Scales sheath along anal fin base covering bases of unbranched rays and about ten first branched rays. Predorsal scales 11-14 in regular series.

Dentary with 4 larger teeth, followed by 4 to 9 small teeth (Fig. 2). Larger teeth penta- to heptacuspitate. In some specimens, first small tooth (fifth tooth counted from mandibular symphysis) more developed than following ones, although distinctly smaller than preceding four teeth. Small teeth uni-, bi-, tri-, and pentacuspitate. Premaxilla with two tooth rows. Inner row with 5 (rarely 4) teeth: tri- to heptacuspitate. Outer row with 4 (rarely 3 or 5) teeth: tri- and pentacuspitate. Maxilla with 1 to 3 teeth, tri- and pentacuspitate. Cuspids of different sizes, central always larger than lateral and arranged in straight line.

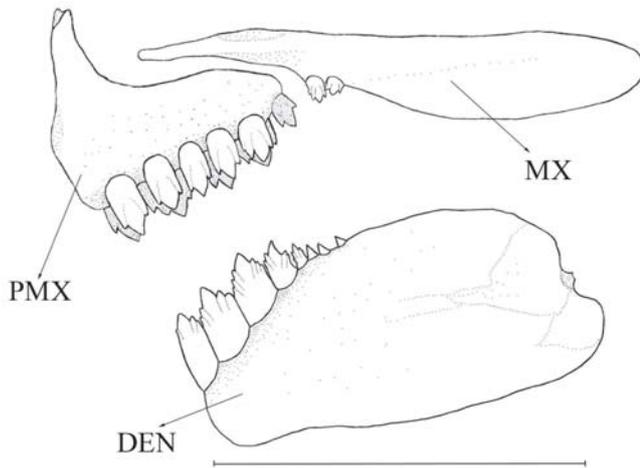


Fig. 2. *Astyanax xavante*, ICLMA 503, 35.0 mm SL, non-type, lateral view of left side of upper and lower jaw teeth, scale = 5 mm (DEN: dentary; MX: maxilla; PMX: premaxilla).

Coloration in life. Brownish background (Fig. 3). Dorsum of head and trunk brown. Side of head cream. Flank brownish above lateral line; lower flank greenish-silver. Branchiostegal region and ventral trunk area whitish. Two vertical brown diffuse humeral spots. First spot located between 2nd and 6th scales behind opercle margin; its depth includes three scale rows above and two below lateral line. Second humeral spot located 2-3 scales posterior to first spot; pale, bar-shaped area between both spots. Pale areas also anterior to and below humeral spots. Lateral wide stripe brownish, with diffuse shape on body flank, including 1st, 2nd and 3rd scale rows above and 1st scale row below (this on vertical through about half of anal-fin) lateral line. Middle caudal rays black from 7th to 11th or 12th rays, including their extremities.

Proximal half of dorsal fin yellowish and blackish on distal half of first 3-5 branched rays. Proximal anal fin yellowish and distal half orangish-yellow, with black border, especially on anterior and middle thirds. Adipose and pectoral fins yellowish. Proximal half of pelvic fin yellowish and orangish-yellow on distal halves of rays. Distal upper and lower caudal-fin lobes reddish, and middle rays yellowish. Dark spot on pupil.

Coloration in alcohol. Background slightly brownish with wide brown diffuse stripe on flank, usually from second humeral spot to caudal fin base; its width encompassing 1st, 2nd and 3rd scale rows above and 1st scale row below (this on vertical through about half of anal fin) lateral line. Dorsum and upper lateral head regions dark brown; head lower lateral and branchiostegal region cream or slightly whitish. Dorsum trunk dark brown, lateral upper dorsal trunk greenish-brown, and lower lateral whitish-brown. Ventral trunk cream or slightly white.

Conspicuous brown first humeral spot, similar to somewhat diffuse, inverted triangle shape, width about four-five scales and depth of about five scales, two below and three above lateral line. Inconspicuous or faint second bar-shaped brownish humeral spot little behind first humeral spot, sometimes mixed with brown lateral stripe; pale or whitish anterior areas between and below humeral spots. Black middle caudal rays, from 7th to 11th or 12th, with its extremities included.

Dorsal fin hyaline or translucent, blackish or not, on distal half of first three-five branched rays. Anal fin hyaline or translucent, with blackish ray tips. Caudal-fin lobes slightly blackish or translucent; middle caudal rays black. Adipose, pectoral, and pelvic fins hyaline, translucent or slightly blackish. Pupil with dark spot.

Habitat and ecological notes. *Astyanax xavante* inhabits crystalline water streams with flow from 0.05 to 0.70 m³/s. There is a reduced number of pools along these watercourses, but there are many rapids and accentuated falls, some up to 30 m high. The bottom of the rapids is generally composed of stone and gravel-stone. Sand and small silt and clay fractions prevail at the bottom of the pools. In general, the rapids are typical of mountain streams with fast-flowing water and gravel, rocky, and sandy bottoms. The banks are covered by riparian forest which prevents most light penetration and have little or no marginal herbaceous vegetation. There are many exposed roots from erosion and many tree trunks, branches and submerged leaves, in various stages of decomposition. The fishes preferentially occupy the water surface and the spaces among roots and branches. They usually form schools with up to two dozen individuals, but schools with about 150 individuals have also been observed. They are more abundant in the upper and middle courses of the córrego Avoadeira, and their frequency decreases downstream.

Astyanax xavante is seemingly the only species inhabiting above the cachoeira Pé da Serra, the lowest of all twelve waterfalls at this creek. *Astyanax xavante* was collected about 0.5 km below that waterfall syntopically with *A. argyrimarginatus*, *A. asuncionensis*, *A. elachylepis*, *Knodus* sp. (Characidae), and *Aequidens tetramerus* (Cichlidae), despite the reduced frequency of the latter. All the collections were conducted in the daytime.

Astyanax xavante is an opportunistic omnivorous fish. Studies on the feeding ecology of this species have shown that from a total of 357 examined stomachs, 90.4% contained some kind of food and 9.6% were empty. A lot of food of



Fig. 3. *Astyanax xavante*, MZUSP 100376, 47.3 mm SL, paratype, from córrego Avoadeira, rio Araguaia basin, Barra do Garças, Mato Grosso (upon capture).

allochthonous origin, primarily composed of terrestrial insects (Hymenoptera, present in 29% of the stomachs; Diptera, 14.1%; Homoptera, 4.2%; and Hemiptera, 3.7%) was found in the stomachs, as well as materials of plant origin. Mainly leaves, small pieces of wood, tips of roots, flowers, fruits, and seeds were present in 48% of the stomachs examined. The majority of autochthonous foods identified were composed of aquatic insects (mainly adults, larvae and nymphs of Odonata, Trichoptera and other insects) present in 18% of the stomachs examined, and mites observed in 4.2% of the stomachs. Other food items found in smaller proportions were Ostracoda crustaceans. Filamentous algae were found in 12.3% of the individuals. Fish scales were observed in 9.3% of the total samples with food, and Protista in 2.8%, reinforcing the opportunistic behavior of these fish.

Studies conducted on 357 fish specimens during the dry season (July to October 1992) and flooded season (February and March 1993) showed individuals in all stages of sexual maturity, except for the specimens collected on July 19, 1992, when all individuals were ready for spawning. Fish ready for spawning were found in all collections, as well as many small, young specimens. The gonads, although mature, had a small number of oocytes compared to other mature fish. Thus, it seems evident that *A. xavante* has a long spawning period. The highest percentages of sexually mature individuals occurred in the dry months. The smallest mature male specimen had 26 mm SL; the smallest female, 25 mm SL. Hooks in the male fins were not seen in any reproductive phases.

Geographical distribution. Known from the type locality, córrego Avoadeira, a middle rio Araguaia tributary located in the Parque Estadual da Serra Azul, Barra do Garças, Mato Grosso. Serra Azul is located in the extreme south of the Serra do Roncador, at the beginning of the great Central Brazilian

Plateau, whose direction is mainly south-north.

Etymology. The specific epithet *xavante* is a reference to the Xavante ethnic group, constituted by the natives inhabiting the Serra do Roncador and middle rio Araguaia, Mato Grosso, Brazil. A noun in apposition.

Popular name. “Pe’auptabi” in Xavante language.

Discussion

Astyanax xavante has the larger body depth in about two to three scales ahead of dorsal-fin origin, snout short but not abruptly tapered, and head not massive. These features are enough to distinguish it from species of the *A. scabripinnis* complex *sensu* Bertaco & Lucena (2006), although overlapping of other characteristics does occur with species of this complex.

Most *Astyanax* species described more recently have restricted geographical distribution (*e.g.*, *A. aramburui* Protogino, Miquelarena & López, *A. biotae* Castro & Vari, *A. brachypterygium* Bertaco & Malabarba, *A. chico* Casciotta & Almirón, *A. cremnobates* Bertaco & Malabarba, *A. endy* Mirande, Aguilera & Azpelicueta, *A. epiagos* Zanata & Camelier, *A. henseli* Melo & Buckup, *A. hermosus* Miquelarena, Protogino & López, *A. ita* Almirón, Azpelicueta & Casciotta, *A. jacobinae* Zanata & Camelier, *A. latens* Mirande, Aguilera & Azpelicueta, *A. leonidas* Azpelicueta & Casciotta, *A. ojiara* Azpelicueta & Garcia, *A. pampa* Casciotta, Almirón & Azpelicueta, *A. paris* Azpelicueta, Almirón & Casciotta, *A. puka* Mirande, Aguilera & Azpelicueta, *A. pynandi* Casciotta, Almirón, Bechara, Roux & Ruiz Diaz, *A. saguazu* Casciotta, Almirón & Azpelicueta, *A. totae* Haluch & Abilhoa, *A. troya* Azpelicueta, Casciotta & Almirón, *A. tupi* Azpelicueta, Mirande & Almirón, and *A. turmalinensis*

Triques, Vono & Caiafa), and a few species are widely distributed (*A. altiparanae* Garutti & Britski, *A. argyrimarginatus*, *A. bockmanni* Vari & Castro, *A. elachylepis*, and *A. schubarti* Britski. *Astyanax altiparanae* and *A. bockmanni* have been incorrectly identified for a long time). Restricted geographical distribution seems to occur also with *A. xavante*. Although numerous and extensive collections have been made in the middle rio Araguaia streams, *A. xavante* was not recorded in any other place. The recent descriptions of the *Astyanax* species with restricted geographical distribution confirm that the genus is poorly known taxonomically, and this suggests that many species should be described with better collection efforts, especially in small headwater stream basins in areas that remain unexplored.

The stream where *A. xavante* was collected shows local peculiarities, and the longitudinal distribution of this species is very interesting. The creek possesses small water volume, and it is located in the mountain area. Approximately in the first 300 m, i.e., above the first waterfall, only tadpoles (Anura, Amphibia) are found among vertebrates. From this point and along the stream down to the cachoeira Pé da Serra (situated very close to the rio Araguaia), the fish fauna consists exclusively of *A. xavante*, which is very abundant. Around the final 1,500 m, between the cachoeira Pé da Serra and the rio Araguaia, the occurrence of the new species decreases, and these fish are not found near the stream mouth. The córrego Avoadeira is about 11 km long, its springs are approximately 520 m, and its mouth is at 316 m above sea level. Their drainage basin is located entirely in the Parque Estadual da Serra Azul (PESA), an environmental protected area with 11,000 hectares. The region is dominated by agriculture and cattle farms, and the region is presently suffering an anthropogenic impact, mostly by habitat destruction due to the increase in farmland. In the last years there have been frequent fires which swept the whole escarpment, destroying vast expanses of the cerrado habitat. Environmental recovery is hindered by the high frequency of fires, which continuously expose the soil to erosion. As a consequence of this process, the riparian forest may disappear and its bottom will turn into sand, endangering the environment and affecting the survival of *A. xavante*.

The size reached by *Astyanax xavante* is comparable to that of *A. biotae*, *A. brachypterygium*, *A. epiagos*, *A. guianensis*, *A. hastatus* Myers (cf. Melo, 2001), *A. ita*, *A. kullanderi*, *A. latens*, *A. nicaraguensis* Eigenmann & Ogle, *A. symmetricus* Eigenmann, and *A. turmalinensis*, for example. Among the *Astyanax* species effectively recorded in the inventory of the vast drainage of Araguaia-Tocantins, *A. xavante* is the smallest in size (maximum SL 59.6 vs.: *A. argyrimarginatus* with 129.4 mm SL; *A. asuncionensis*, 104.2 mm; *A. elachylepis*, 143.8 mm; *A. kullanderi*, 64.4 mm; *A. goyacensis*, 85.4 mm; *A. novae*, 98.1 mm, and *A. unitaeniatus*, 80.5 mm).

Comparative material. All from Brazil, except FMNH 54643; range of SL is given in millimeters. *Astyanax argyrimarginatus*: MZUSP 48268, holotype, 62.3, córrego Jaraguá, rio Araguaia

drainage, Aragarças, GO. *Astyanax asuncionensis*: FMNH 54643, syntypes, 8, 21.0-70.7, Asunción, Paraguay; ICLMA 504, 1, 65.0, córrego Avoadeira, rio Araguaia drainage, Barra do Garças, MT; MZUSP 48195, 2, 89.4-104.2, lagoon of the Cachoeira de Campos, rio Coxim, rio Paraguay drainage, Coxim, MS; MZUSP 18770, 68, 26.8-70.8, Campo do Jofre or rio Pixaim, rio Paraguay drainage, Poconé, MT. *Astyanax elachylepis*: MZUSP 100468, 9, 52.0-71.0, córrego Avoadeira, below cachoeira Pé da Serra, rio Araguaia drainage, Barra do Garças, MT. *Astyanax goyacensis*: MCZ 89558, holotype, 76.0, Goiás, GO; MZUSP 4905, topotypes, 5, 57.2-75.7, rio Vermelho, rio Araguaia drainage, Goiás, GO. *Astyanax kullanderi*: MZUSP 45288, 3, paratypes, 40.7-51.3, stream tributary of rio Perdidos, rio das Mortes, rio Araguaia drainage, Primavera do Leste, MT. *Astyanax novae*: FMNH 54641, type-series, 11, 24.4-45.4, rio Sapão, rio São Francisco drainage, Prazeres, BA; FMNH 54642, 10, 27.0-67.0, above cachoeira da Velha, rio Nova, rio Tocantins drainage, Ponte Alta do Tocantins, TO; MZUSP 68448, topotypes, 6, 49.3-77.1, cachoeira da Velha, rio Nova, rio Tocantins drainage, Ponte Alta do Tocantins, TO; MZUSP 89660, 2, 47.8-59.6, ribeirão São José, tributary of rio Sapão, São Marcelo (10°58'40"S 05°32'37"W), BA; MZUSP 89661, 2, 31.3-35.3, córrego Livramento, tributary of rio Preto, São Marcelo (10°59'26"S 05°31'48"W), BA; MZUSP 89644, 4, 49.7-78.0, córrego Sassafras, tributary of rio Sapão, Coaceral (10°38'06"S 05°50'19"W), BA; MZUSP 87318, 10, 14.8-53.9, creek flowing to ribeirão São Raimundo, Estreito (06°47'13"S 07°06'07"W), MA; MZUSP 87327, 4, 36.5-80.3, ribeirão São Raimundo, near mouth of rio Itauaieras, Estreito (06°41'14"S 07°07'48"W), MA; MZUSP 87450, 4, 20.6-55.9, ribeirão Bofe, Estreito, MA; MZUSP 87527, 11, 28.8-39.2, rio Imbiaraçu, Feira Nova (06°57'27"S 06°50'16"W), MA; MZUSP 87543, 19, 29.2-101.5, creek flowing to rio Caraíbas, in the road Riachão/Feira Nova (07°02'45"S 06°36'09"W), MA; *Astyanax paranae*: MZUSP 55000, 27, 36.1-54.1, creek tributary of rio Tibagi, rio Paranapanema drainage, upper Paraná system, Fazenda das Rosas, Castro, PR. *Astyanax rivularis*: MZUSP 39724, 33 from 53, 49.3-77.8, córrego Guará, rio São Francisco drainage, Três Marias, MG. *Astyanax scabripinnis*: BMNH 1917.7.14.15, holotype, 71.4, Rio de Janeiro. *Astyanax unitaeniatus*: MZUSP 40542, holotype, 55.9, ribeirão Macambira, rio Tocantins drainage, Iaciara, GO.

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