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Research note

Partial albinism in *Rhinelepis aspera* from the Upper Paraná Basin, Brazil, with a review of albinism in South American freshwater fishes

Albinismo parcial en Rhinelepis aspera *de la cuenca del Alto Paraná, Brasil, con una revisión de albinismo en peces de agua dulce sudamericanos*

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Abstract

This study reports a case of partial albinism in *Rhinelepis aspera* from the Aguapeí River, Upper Paraná Basin, Brazil and provides a review of albinism cases in freshwater fishes from South America. The captured specimen has depigmentation throughout almost its entire body, with pigmented eyes and little dark spots on the dorsal and caudal fins. It is an adult male, and we suggest that due to the benthic habitat, it would be able to reach adult size, avoiding predators. The review shows a scarcity of this phenomenon in nature.

Keywords: Albinism; Leucism; Fish; Loricariidae

Resumen

Este estudio registra un caso de albinismo parcial en *Rhinelepis aspera* del río Aguapeí, cuenca del Alto Paraná, Brasil y proporciona una revisión de los casos de albinismo en los peces de agua dulce de la América del Sur. El ejemplar capturado tiene despigmentación en casi todo el cuerpo, con los ojos pigmentados y pequeñas manchas oscuras en las aletas dorsal y caudal. Es un macho adulto y se sugiere que, debido al hábitat bentónico, el espécimen hubiera sido capaz de alcanzar el tamaño adulto, evitando a los depredadores. La revisión muestra una escasez de este fenómeno en la naturaleza.

Palabras clave: Albinismo; Leucismo; Peces; Loricariidae

Albinism is a pigmentation phenomenon characterized by the total loss of tegument and retina pigmentation, while individuals with partial albinism, also known as leucism, can have their eyes and some parts of their body pigmented (Reum, Paulsen, Pietsch, & Parker-Stetter, 2008; Steven, 2002). These phenomena may be related to environmental factors, such as exposure to heavy metals (Oliveira & Foresti, 1996), heredity (Ueda, Ishinabe, & Jeon, 2007), or artificial selection of albino individuals by aquarists (Brito & Caramaschi, 2005). The aims of this study are to report a case of partial albinism in *R. aspera* and to present a review of natural cases of albinism in South American freshwater fishes.

The Neotropical ichthyofauna is the most diverse in the world, with about 6,000 species of freshwater fishes described (Reis, Kullander, & Ferraris, 2003). However, albinism cases are rarely

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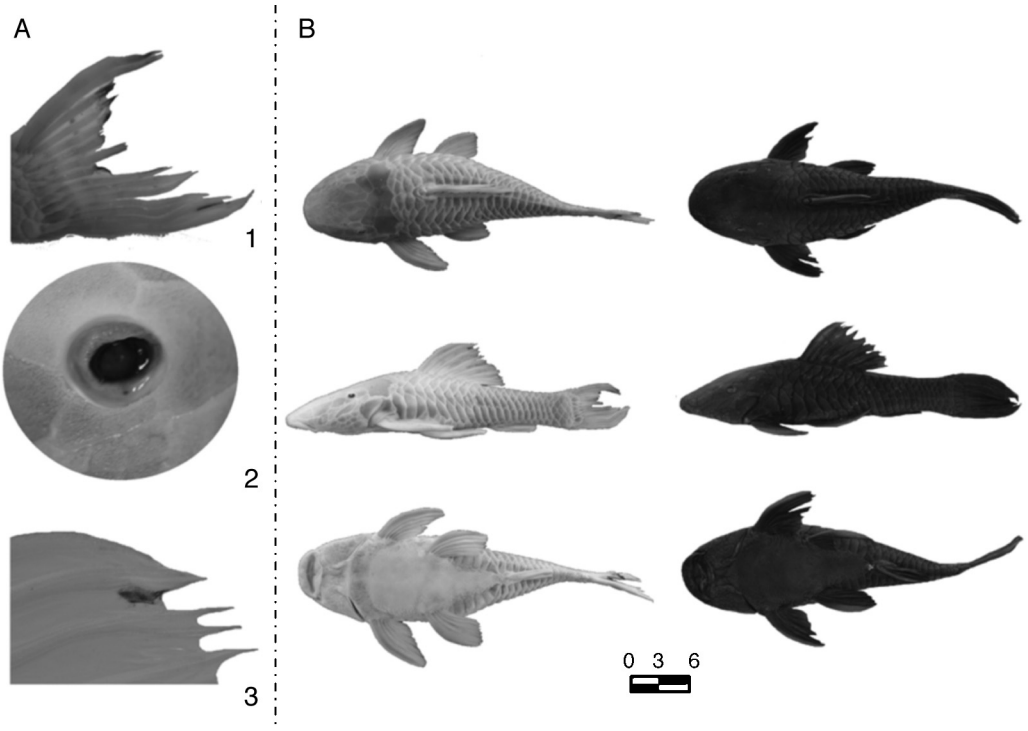

Figure 1. (A) Details of the pigmented area characteristics of the individual with partial albinism; (B) individual with partial albinism (left) and normal individual (right) sampled in the Upper Paraná Basin, São Paulo, Brazil. Scale in cm.

reported in the literature, especially those occurring naturally. Moreover, total or partial albinism is occasionally recorded in teleosts worldwide (Reum et al., 2008). Albinism is a phenomenon also found in populations of cavefishes, as reported for *Astyanax mexicanus* (Bilandžija, Parkhurst, & Jeffery, 2013). In these cases all individuals of the populations present albinism, although this situation does not apply for this study.

Rhinelepis aspera Spix and Agassiz, 1829 (known as the black armored catfish) belongs to Loricariidae, an important family within the order Siluriformes, with approximately 800 species (Queiroz et al., 2013). *Rhinelepis aspera* is distributed along the Upper Paraná and São Francisco River Basins and is commonly used as a fishery resource. It inhabits areas with a rocky bottom and flowing waters, and exhibits iliophagous and reophilic behavior and reophilic behavior. Its size of first maturation is 25 cm, and it reaches a maximum size of 54 cm (Agostinho, Gomes, Suzuki, & Júlio, 2003; Costa, Okada, Agostinho, & Gomes, 2012).

The specimen of *R. aspera* with partial albinism was collected with gillnets (7 cm between adjacent nodes) in November, 2014 in the Aguapeí River (21°03′49.34″S; 51°45′13.72″W), Upper Paraná Basin, Castilho Municipality, São Paulo, Brazil. The fish is deposited in the "Coleção do Laboratório de Biologia e Genética de Peixes", UNESP, Botucatu (Voucher: LBP-19697).

In order to assess possible morphometric differences, measurements were made following Armbruster (1998) for the individual with partial albinism and for 6 normal individuals (Voucher: LBP-12659 and LBP-7394) sampled in the same river basin.

The specimen sampled is an adult male with depigmentation in the body, except for the eyes and little dark spots on the dorsal and caudal fins, characteristic of partial albinism (Fig. 1A and B). The measurements taken for the individual with partial albinism and for the normal specimens were similar and in accordance with the range for this fish species (Table 1). Table 2 summarizes the rare cases of albinism or partial albinism in freshwater fishes from South America.

Previous records of pigmentation anomaly in *R. aspera* occurred 50 years ago (Luengo, 1965), suggesting how rare this phenomenon is, even though the species is commonly exploited as a fishery resource (Costa et al., 2012). Moreover, this is the first report of the occurrence of this genetic alteration in fish from the Aguapeí River.

This phenomenon is probably rare in South America, since there are only 16 reported cases in 14 species from more than 6,000 existing fish species (Reis et al., 2003). Most cases were described for the order Siluriformes, in representatives of the families Pimelodidae and Loricariidae. Pigmentation mutations are more common among nocturnal or cryptic species than among diurnal and non-cryptic species, given that the first are less susceptible to predation (Piorski & Nunes, 2010), increasing the chances of reaching the adult stage (Reum et al., 2008). Thus, the benthonic habit of *R. aspera* may have helped the individual with partial albinism to reach sexual maturity.

The morphometric measurements of the individual with partial albinism showed no variations in relation to the normal specimens. Therefore, we conclude that despite the lack of pigmentation, the individual with partial albinism performed its biological functions normally.

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Table 1
Mean, standard deviation, and amplitude for normal individuals (Armbruster, 1998) and for the study area of the individual with partial albinism sampled in the Aguapeí River, Upper Paraná Basin, São Paulo, Brazil.

Measurements	Individual with partial albinism	Normal individuals	
		Mean ± SD	Range
Standard length	306.0	315.8 ± 12.9	293.0–329.0
Predorsal length/SL	43.9	44.1 ± 2.6	41.7–49.3
Head length/SL	35.6	35.2 ± 1.0	33.9–36.4
Orbit diameter/SL	3.7	3.5 ± 0.3	3.1–3.9
Snout length/SL	22.2	22.4 ± 0.5	21.9–23.3
Interorbital width/SL	18.4	19.4 ± 0.6	18.2–20.1
Thorax length/SL	18.6	19.5 ± 0.5	18.8–20.1
Pectoral-spine length/SL	26.0	24.0 ± 1.8	21.2–26.8
Abdomen length/SL	28.3	26.3 ± 0.9	25.5–27.7
Pelvic-spine length/SL	22.9	22.2 ± 1.8	19.0–24.2
Postanal length/SL	27.5	22.4 ± 1.2	21.0–24.5
Anal-fin length/SL	17.7	16.8 ± 1.2	15.2–18.8
Caudal depth/SL	13.0	12.6 ± 0.3	12.2–13.1
Dorsal-caudal length/S	29.0	32.6 ± 0.9	31.3–33.7
Dorsal-fin length/SL	21.5	21.4 ± 0.6	20.5–22.1
Dorsal-spine length/SL	23.2	19.6 ± 0.9	18.0–20.7
Head depth/SL	19.2	18.2 ± 1.3	15.4–19.4
Width at anal fin/SL	16.9	15.3 ± 2.5	12.6–20.0
Cleithral width/SL	31.4	31.4 ± 1.6	28.2–33.0

Table 2
List of albinism and partial albinism cases reported in freshwater fishes from the Neotropical region.

Order	Family	Species	Locality	Reference
Characiformes	Erythrinidae	*Hoplias malabaricus* (Bloch 1794)	Brazil	Silva, Araújo, and Bicudo (2013)
Gymnotiformes	Gymnotidae	*Gymnotus carapo* Linnaeus 1758	Brazil	Campos-da Paz and Caramaschi (1994)
		Gymnotus carapo Linnaeus 1758	Brazil	Oliveira and Foresti (1996)
Lepidosireniformes	Lepidosirenidae	*Lepidosiren paradoxa* Fitzinger 1837	Argentina	Azpelicueta and Braga (1984)
Siluriformes	Callichthyidae	*Corydoras paleatus* (Jenyns 1842)	Brazil	Fach (1963)
		Megalechis thoracata (Valenciennes 1840)	Argentina	Taberner, Fernández-Santos, and Castelli (1976)
		Corydoras aeneus (Gill 1858)	Brazil	Burgess (1989)
	Doradidae	*Oxydoras knerii* Bleeker 1862	Argentina	Del Barco and Panattieri (1980)
	Loriicaridae	*Rhinelepis aspera* Spix & Agassiz	Uruguay	Luengo (1965)
		Hypostomus plecostomus (Linnaeus 1758)	Tropical South America	Burgess (1989)
		Schizolecis guntheri (Miranda Ribeiro 1918)	Brazil	Brito and Caramaschi (2005)
	Pimelodidae	*Zungaro zungaro* (Humboldt 1821)	Argentina	Taberner et al. (1976)
		Rhandella minuta (Lütken)	Brazil	Sazima and Pombal (1986)
		Phractocephalus hemioliopterus (Bloch & Schneider 1801)	Amazon	Burgess (1989)
		Pseudopimelodus sp.	Unknown locality	Burgess (1989)

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