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Short Communication

First record of partial fin albinism in channel catfish *Ictalurus punctatus* Rafinesque, 1818 (Siluriformes: Ictaluridae) from china

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Introduction

Albinism is an absence of pigments or nonfunctional pigments, caused by a series of genetically determined disorders of the melanin pigmentary system (Kinnear *et al*., 1985; Reum *et al*., 2008). There are two types of albinism: (1) complete albinism, which is the absence of integumentary and retinal melanin, due to defects in the integumentary and retinal melanophores , and (2) partial albinism or leucism, which is with reduced or absent integumentary pigments, but with pigmented retinas, leading to diminished or lack of body coloration and darkly pigmented eyes. Albinism has been reported in numerous aquatic organisms, such as marine mammals, teleosts, sharks, and invertebrates (Follett and Dempster, 1966; Dawson, 1967; Hatler, 1974; Hain and Leatherwood, 1982; Shinohara and Amaoka, 1993; Reum *et al*., 2008; Muto *et al*., 2015). Albinism is controlled by a single autosomal recessive allele for most species, except in goldfish, which is controlled by two genes with dominant epistatic gene interaction (Yamamoto, 1973).

Channel catfish *Ictalurus punctatus*, is naturally distributed between southern Canada and northern Mexico (Wang, 1986). It is the leading cultured species in the United States (Liu *et al*., 2016) and has been increasingly cultured in China (Fishery Bureau, 2016).

Here we describe the first record of partial fin albinism in channel catfish *I. punctatus* found in the farm of Freshwater Fisheries Research Institute

of Jiangsu Province, China. Possible causes for the comparative rarity of anomaly are discussed.

Materials and methods

In June 2017, two albino specimens of channel catfish was caught in the farm of National Genetic Breeding Center of Channel Catfish, Freshwater Fisheries Research Institute of Jiangsu Province located in Zhenjiang, China. Both albino specimens were four-years-old, which were individuals from the third generation population of a selective breeding program to improve the growth rate (Zhong *et al*., 2016). Total length (TL), and body weight were examined. The sex was determined by checking genital pore and genital papillae in the belly.

Results and discussion

Two albino specimens were found from the third generation population of channel catfish. The first individual was an adult male of 587 mm total length (TL), and body weight of 3.65 kg, having a pinkish-yellow body. However, eyes of the specimen were normally pigmented, indicating a case of partial albinism (Fig. 1a). The second specimen was also an adult male, measuring 552 mm TL and weighing 3.10 kg. The entire body and eyes of the specimen were normally pigmented, while all fins except adipose fin were partial albino with an irregular white margins (Fig. 1b). Other morphological and meristic features of the two albino specimens were similar to normal channel catfish individuals.

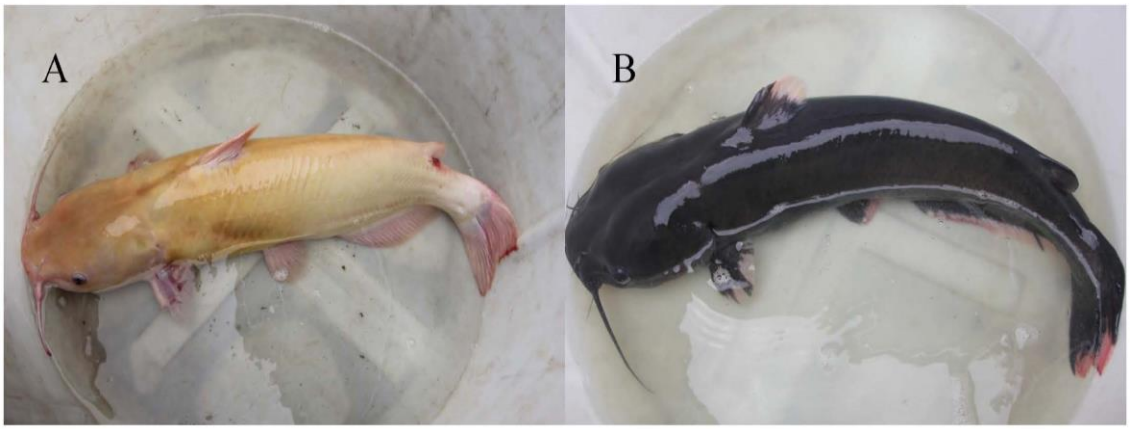

Figure 1: Two partial albino specimens of channel catfish. The first specimen has a pinkish-yellow body and dark eyes (A). The entire body and eyes of the second specimen are normally pigmented, but each fin (except adipose fin) was partial albino with an irregular white margin (B).

Channel catfish is the primary aquaculture species in the United States. Albino specimens have been report in wild stocks of channel catfish from many localities (Aitken, 1937; Menzel, 1944, 1958; Brady *et al*., 1962; Emmens and Axelrod, 1968). In hatchery populations, albino phenotypes of channel catfish were considerably increased (Nelson, 1959; Prather, 1961; Page and Andrews, 1975; Bondari, 1981). And comparisons

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between Albino and Normal Channel Catfish have been studied in many straits, such as production (Prather, 1961), growth (Hill, 1974; Page and Andrews, 1975; Bondari, 1984a, b), reproduction (Goudie *et al*., 1992), quality (Heaton *et al*., 1973), Heat tolerance (Allen, 1968). All reported albino specimens of channel catfish had a pinkish body, which may contain some specimens with dark eyes. Partial albino specimens of channel catfish was only reported by Parker and Klar (1987), which have white strip or spots along the lateral line system. However, partial fin albinism has not been observed, even in any catfish up to now.

Albinism is generally the result of combinations of homozygous recessive mutations from pigmented parents, and in particular, albinos are often unable to synthesize tyrosine and melatonin hormones (Carden *et al*., 1998). The mutation occurs as a complete or incomplete elimination of the black pigmentation otherwise normally present on the skin, on the retina or other body parts. Previous studies using progeny testing suggested that albinism of channel catfish is also controlled by a recessive mutation impacting the color of the whole fish body (Bondari, 1981). A deletion in the Hermansky-Pudlak syndrome 4 (*Hps4*) gene demonstrated by GWAS analysis appears to be responsible for albinism in channel catfish (Li *et al*., 2017).

Albinism in fishes is rare in wild, but common in reared fishes. It is suggested that albino specimens could face high risk of predation due to being conspicuous to predators (Sazima and Pombal, 1986). Therefore, albino individuals in wild have little chance of survival to adulthood due to increased risk of predation. Reared fishes cultured in the farm meet much fewer predators. Meanwhile, reared fishes always have a small effective population size and favoring inbreeding. Therefore, the offspring are much easier to be homozygous recessive at albino locus.

By contrast, it seems that albinism may have less influence in feeding, growth and reproduction (Joseph, 1961; Sandoval-Castillo *et al*., 2006; Lipej *et al*., 2011; Ibrahim and Jawad, 2017). In channel catfish, several yield trials have been conducted to compare growth, survival, fecundity and reproductive performance of albino and normal individuals. However, the results is somewhat mixed, no definitive statements could be made (Tave, 1994). The social consequences of albinism for catfish showed that albinism can be associated with lower aggressiveness and with reduced shoaling behavior preference (Slavík *et al*. 2015, 2016).

Many studies have also reported environmental factors (Aritaki and Seikai, 2004), light intensity (Bolker and Hill, 2000), feeding during larval stages (Yamamoto *et al*., 1992; Kazanawa, 1993), the hormones (Tagawa and Aritaki, 2005) involved in body color anomalies. The incidence of albinism can be artificially increased in fish by exposing the eggs to heavy metals (Westerman and Birge, 1978) and may occur in fry originating from crosses in which adult specimens have been exposed to heavy metals (Oliveira and Foresti, 1996), as these metals have

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the ability to create a genetic random alteration (Wakida-Kusunoki and Amador-del-Ángel, 2013). While partial albinism may result from certain obstruction in the process of gene expression, environmental conditions or pathogens. In the future, additional studies are necessary to evaluate the reason and inheritance of the special albinism.

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