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First Report of Albinism in Turkish Crayfish *Pontastacus leptodactylus* (Eschscholtz, 1823) (Crustacea, Decapoda, Astacidae)

Semih Kale[1]✉ • Selçuk Berber[2] • Deniz Acarlı[3] • Tekin Demirkıran[4] • Pervin Vural[5] • Sefa Acarlı[6] • Bayram Kızılkaya[6] • Evren Tan[7]

[1] Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, Department of Fishing and Fish Processing Technology, Çanakkale, Turkey, semihkale@comu.edu.tr
[2] Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, Department of Basic Sciences, Çanakkale, Turkey, selcukberber@comu.edu.tr
[3] Çanakkale Onsekiz Mart University, Gökçeada School of Applied Sciences, Department of Fisheries Technology, Çanakkale, Turkey, denizacarli@comu.edu.tr
[4] Çanakkale Onsekiz Mart University, Graduate School of Natural and Applied Sciences, Department of Fishing and Fish Processing Technology, Çanakkale, Turkey, tekindemirkiran@hotmail.com
[5] Çanakkale Onsekiz Mart University, Bayramiç Vocational School, Department of Fisheries, Çanakkale, Turkey, pervinvural@comu.edu.tr
[6] Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, Department of Aquaculture, Çanakkale, Turkey, sefaacarli@comu.edu.tr; bayram342001@yahoo.com
[7] Çanakkale Onsekiz Mart University, Graduate School of Natural and Applied Sciences, Department of Aquaculture, Çanakkale, Turkey, evrentantr@gmail.com

✉ Corresponding Author: semihkale@comu.edu.tr

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ABSTRACT

A female albino crayfish *Pontastacus leptodactylus* (Eschscholtz, 1823) was captured from Atikhisar Reservoir in Çanakkale, Turkey on July 18, 2020. The albino crayfish is lacked melanin that is normally found on normal crayfish. The compound eyes of the albino crayfish were black as in normal crayfish. Morphometric characteristics were measured and the total length was 101.98 mm, carapace length was 50.04 mm, carapace width was 26.56 mm and weight was 35.90 g. Albinism is a widespread disorder in the animal kingdom and is triggered by the absence of melanin in the skin, eyes, or hair. Investigation on albinism has commonly focused on mice and humans. Therefore, there is restricted research on albino crayfish. In the present paper, the occurrence of albinism in crayfish is firstly reported from Atikhisar Reservoir in Çanakkale, Turkey. Therefore, this paper significantly contributes to the scientific literature by providing the first knowledge on the presence of albino crayfish in the Atikhisar Reservoir, Çanakkale, Turkey.

INTRODUCTION

Albinism is a widespread disorder in animals and is triggered by the absence of melanin in the skin, eyes, or hair (Potterf et al., 1998). Albinism is a genetic disease caused by a recessive gene (alb) in the homozygous condition that results in the lack of melanin and distribution of chromophores in animal skin (Browder, 2005; Jablonski et al., 2014). Bechtel (1995) described phenotypically this anomaly as the white coloration of the skin and by the red iris. Wild albino individuals are very scarce in the natural environment (Zhao et al., 2015). Albino individuals are more visible prays for predators with their attractive colours.

Albino individuals of the lobster and crab species were reported in the literature. An albino of crab (*Chionoecetes japonicas*) that lacked red pigment in walking legs and the carapace has been reported by Muraoka & Honma (1993). An albino crab (*Portunus (Portunus) trituberculatus*) that lacked light blue and dark green pigments was also reported by Ariyama (1997). Okamoto & Misyuku (1998) reported an albino of the spiny lobster. Nakatani (1999) firstly reported albinism in crayfish (*Procambarus clarkii*) which is a male albino crayfish that lacked red pigments and melanin except in its compound eyes. Nakatani (2000) examined the possibility of albinism in crayfish due to hormonal defects. Begum et al. (2010) studied the reproductive capacity of albino morphs of *P. clarkii*.

Until nowadays, there has been restricted research focused on albino crayfish. Therefore, this paper aims to provide the first document on albino crayfish from a reservoir in Çanakkale, Turkey.

MATERIAL AND METHODS

A specimen of *Pontastacus leptodactylus* (Eschscholtz, 1823) was collected from Atikhisar Reservoir in Çanakkale, Turkey. The specimen was captured using a fyke-net. The fyke-nets with 17 mm mesh size were placed on the bottom of the reservoir at 5 m water depth. The soaking time of fyke-nets was 3 days. The fyke-nets were collected from the reservoir on 18 July 2020. Sampling was conducted during the daytime. The ground has a muddy substrate in the sampling location.

Atikhisar Reservoir was constructed on Sarıçay Stream to supply water for drinking purposes (Kale, 2019). The reservoir is the only drinking water source for people inhabiting Çanakkale (Kale & Acarlı, 2019a) and it serves as a water supplier to agricultural and anthropogenic activities for drinking and irrigation purposes around the basin (Kale & Acarlı, 2019a; Kale & Acarlı 2019b).

RESULTS

The specimen examined was a female albino crayfish (*Pontastacus leptodactylus*). The albino crayfish is lacked melanin that is normally found on normal crayfish. Lack of pigmentation was observed in all parts of the body and appendages of the specimen. On the other

hand, the compound eyes of the albino crayfish were black as in normal crayfish. Morphometric characteristics were measured and the total length was 101.98 mm, carapace length was 50.04 mm, carapace width was 26.56 mm, and weight was 35.90 g.

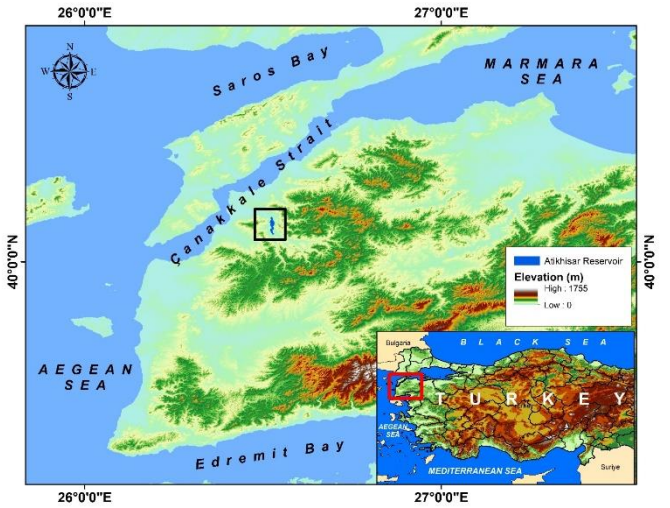

Figure 1. Sampling location of albino crayfish, Atikhisar Reservoir, Çanakkale, Turkey

Figure 2. The albino crayfish individual captured from Atikhisar Reservoir, Çanakkale, Turkey

A comparison of the albino crayfish and normal crayfish was provided for better understanding the colouration between two types of the phenotype (Figure 3). It can be clearly seen that the colour of the albino crayfish is unequivocally different from normal crayfish.

Figure 3. Comparison of normal crayfish and the albino crayfish from Atikhisar Reservoir, Çanakkale, Turkey

The albino crayfish individual was captured at the depth of 5 m from the muddy substrate. The physicochemical characteristics of lake surface water were measured with a YSI probe. The temperature of the lake surface water was 26.9°C, pH was 8.29, dissolved oxygen was 11.49 mg/l, the percentage of dissolved oxygen was 143.10%, the electrical conductivity was 431.50 µs/cm, and the salinity was 0.20 ppt. An extraordinary weather event was not observed during the sampling period.

DISCUSSION

Albino individuals have been reported for few aquatic organisms such as goldfish (Kajishima & Takeuchi, 1977), sea urchin (Seikai, 1985; Kehas et al., 2005), crabs (Muraoka & Honma, 1993; Ariyama, 1997; Nakamura et al., 2001; James, 2005), zebra fish (Hyodo-Taguchi

et al., 1997), flounder (Koga & Hori, 1997), lobster (Okamoto & Misyuku, 1998; Landa-Jaime et al., 2018), turbot (Kelsh et al., 2000), medaka fish (Kehas et al., 2005), rainbow trout (Guo et al., 2007), and sea cucumber (Lin et al., 2013; Fernández-Rivera Melo et al., 2015; Zhao et al., 2015). The first report on the occurrence of albinism in crayfish (*Procambarus clarkii*) was published by Nakatani (1999). The author investigated a male albino crayfish (*P. clarkii*) that lacked red pigments and melanin except in its compound eyes. Then, Nakatani (2000) studied the possibility of albinism in crayfish due to hormonal defects. Begum et al. (2010) scrutinised the reproductive capacity of albino morphs of *P. clarkii*.

This paper reports the first observation of an albino crayfish in the Atikhisar Reservoir. Several factors may cause albinism. Nakatani (1999) revealed that the albino characteristic is recessive to the typical pigmentation of normal crayfish and that the heritage pattern is controlled by Mendelian laws. Kajishima & Takeuchi (1977) noted that it was clearly seen from ultrastructural surveillances on the melanosomes of late-melanising fish that incompletely melanised albino pigment granules could distinguish from normal melanosomes under the control of the *C* gene. Leal et al. (2013) indicated that the existence of albinism in fishes could be affected by random genetic change, water pollution, or genetic changes because of the population size. Zhao et al. (2015) documented that the immediate reason for albinism is the existence of melanocytes or melanin generation syndrome. Tyrosinase (TYR) elicits the melanin generation and the generation occurs in melanosomes. The foremost progressions of melanin synthesis, emission, and absorption are documented by Zhao et al. (2015). These main processes are controlled by various elements, such as cytokines, hormones, and the physicochemical characteristics of the contiguous environs of melanocytes (Lin & Fisher, 2007; Wang et al., 2007; Zhao et al., 2015).

The colour and the pattern of albinism in aquatic organisms differ from the distribution pattern and abundance of pigments in the skin. Zhao et al. (2015) noted that pigments are originated from neural crest cells in fish similar to mammals, and the authors pointed out that these pigments are melanophores, iridophores, erythrophores, and xanthophores. Zhao (2011) documented that albino individuals usually suffer pathological vicissitudes containing anaemia, osteosclerosis, megacolon, inner ear imperfections, and nervous system diseases.

Recreational fisheries, sport fishing, and small-scale fishing activities are allowed under some fisheries management regulations and restrictions in Atikhisar Reservoir. However, there is no professional fisheries activity in the reservoir. Therefore, there is no fishing pressure or overfishing possibility of fisheries resources in the reservoir. On the other hand, no pollution was observed in the lake surface water of the reservoir during the sampling period. Thus, there is no potential cause for albinism in the crayfish except for the lack of melanin in the skin of the

specimen. Hence, further investigations should be carried out to understand the reason for albinism in the crayfish and genetic factors should have experimented in detail. Moreover, as stated by Lin & Fisher (2007), continuously understanding the charities of melanocyte to skin biology would surely make available novel prospects for the avoidance and cure of skin diseases. More investigations are compulsory to understand the reasons causing this phenomenon in different species demonstrating albinism and to assess if abnormal coloration could be considered as an indicator of the habitat quality or populations in extraordinary conditions (Landa-Jaime et al., 2018).

CONCLUSION

The present paper significantly contributes to the scientific literature by providing the first knowledge on the presence of albino crayfish (*P. leptodactylus*) in the Atikhisar Reservoir, Çanakkale, Turkey.

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COMPLIANCE WITH ETHICAL STANDARDS

Authors' Contributions

SB and SK designed the study. SK, SB, DA, TD conducted sampling in the field. SK wrote the first draft of the manuscript. SA, PV, BK, ET helped in the laboratory. All authors have read and revised the manuscript. All authors approved the final version of the paper.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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