



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

Semih Kale¹ • Selçuk Berber² • Deniz Acarlı³ • Tekin Demirkıran⁴ • Pervin Vural⁵ • Sefa Acarlı⁶ • Bayram Kızılkaya⁶ • Evren Tan⁷

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

Please cite this paper as follows:

Kale, S., Berber, S., Acarlı, D., Demirkıran, T., Vural, P., Acarlı, S., Kızılkaya, B., Tan, E. (2020). First Report of Albinism in Turkish Crayfish *Pontastacus leptodactylus* (Eschscholtz, 1823) (Crustacea, Decapoda, Astacidae). *Acta Natura et Scientia*, 1(1): 36-42.

ARTICLE INFO



Received: 17.08.2020

Accepted: 12.10.2020

Keywords

Albino
Pigmentation
Color anomaly
Crayfish
Pontastacus leptodactylus
Atikhisar
Çanakkale
Turkey

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 preys 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.

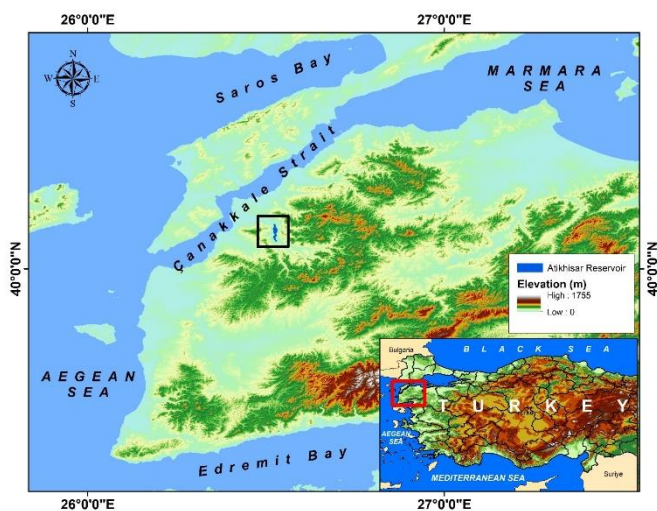


Figure 1. Sampling location of albino crayfish, Atkhisar Reservoir, Çanakkale, Turkey



Figure 2. The albino crayfish individual captured from Atkhisar 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 Atkhisar 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.

ACKNOWLEDGEMENTS

This paper is a part of a research project financially supported by Çanakkale Onsekiz Mart University The Scientific Research Coordination Unit granted to Dr. Selçuk Berber (Project number: FBA-2020-3250). Lab experiments were carried out in the laboratory of Biochemistry; and laboratory of Feed and Food Analysis, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University.

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.

REFERENCES

- Ariyama, H. (1997). Albino of the swimming crab *Portunus (Portunus) trituberculatus* caught in Osaka Bay. *Cancer*, 6, 9-10. https://doi.org/10.18988/cancer.6.0_9
- Bechtel, H. B. (1995). *Reptile and amphibian variants: Colors, patterns, and scales*. Krieger Publishing Company.
- Begum, F., Nakatani, I., Tamotsu, S., & Goto, T. (2010). Reproductive characteristics of the albino morph of the crayfish, *Procambarus clarkii* (Girard, 1852) (Decapoda, Cambaridae). *Crustaceana*, 83(2), 169-178. <https://doi.org/10.1163/001121609X12530988607515>
- Browder, L. W. (2005). Genetic and embryological studies of albinism in *Rana pipiens*. *Journal of Experimental Zoology*, 180(2), 149-155. <https://doi.org/10.1002/jez.1401800202>

- Fernández-Rivera Melo, F. J., Reyes-Bonilla, H., Cantú, A., & Urías, J. (2015). First record of albinism in the brown sea cucumber *Isostichopus fuscus* in the Gulf of California, México. *Marine Biodiversity Records*, 8, e14. <https://doi.org/10.1017/S1755267214001353>
- Guo, H., Huang, B., Qi, F., & Zhang, S. (2007). Distribution and ultrastructure of pigment cells in the skins of normal and albino adult turbot, *Scophthalmus maximus*. *Chinese Journal of Oceanology and Limnology*, 25(2), 199-208. <https://doi.org/10.1007/s00343-007-0199-1>
- Hyodo-Taguchi, Y., Winkler, C., Kurihara, Y., Scharfl, A., & Scharfl, M. (1997). Phenotypic rescue of the albino mutation in the medakafish (*Oryzias latipes*) by a mouse tyrosinase transgene. *Mechanisms of Development*, 68(1-2), 27-35. [https://doi.org/10.1016/S0925-4773\(97\)00128-7](https://doi.org/10.1016/S0925-4773(97)00128-7)
- Jablonski D., Alena, A., Vlček, P., & Jandzik, D. (2014). Axanthism in amphibians: A review and the first record in the widespread toad of the *Bufo viridis* complex (Anura: Bufonidae). *Belgium Journal of Zoology*, 144(2), 93-101. <https://doi.org/10.26496/bjz.2014.69>
- Kajishima, T., & Takeuchi, I. K. (1977). Ultrastructural analysis of gene interaction and melanosome differentiation in the retinal pigment cell of the albino goldfish. *Journal of Experimental Zoology*, 200 (3), 349-357. <https://doi.org/10.1002/jez.1402000305>
- Kale, S. (2019). *Monitoring climate change effects on surface area and shoreline changes in Atikhisar Reservoir by using remote sensing and geographic information system in terms of fisheries management*. [Ph.D. Thesis, Çanakkale Onsekiz Mart University, Çanakkale, Turkey].
- Kale, S., & Acarlı, D. (2019a). Spatial and temporal change monitoring in water surface area of Atikhisar Reservoir (Çanakkale, Turkey) by using remote sensing and geographic information system techniques. *Alinteri Journal of Agriculture Sciences*, 34(1), 47-56. <https://doi.org/10.28955/alinterizbd.574361>
- Kale, S., & Acarlı, D. (2019b). Shoreline change monitoring in Atikhisar Reservoir by using remote sensing and geographic information system (GIS). *Fresenius Environmental Bulletin*, 28(5), 4329-4339.
- Kehas, A. J., Theoharides, K. A., & Gilbert, J. J. (2005). Effect of sunlight intensity and albinism on the covering response of the Caribbean Sea urchin *Tripneustes ventricosus*. *Marine Biology*, 146, 1111-1117. <https://doi.org/10.1007/s00227-004-1514-4>
- Kelsh, R. N., Schmid, B., & Eisen, J. S. (2000). Genetic analysis of melanophore development in zebrafish embryos. *Developmental Biology*, 225(2), 277-293. <https://doi.org/10.1006/dbio.2000.9840>
- Koga, A., & Hori, H. (1997). Albinism due to transposable element insertion in fish. *Pigment Cell & Melanoma Research*, 10(6), 377-381. <https://doi.org/10.1111/j.1600-0749.1997.tb00695.x>
- Landa-Jaime, V., Aguilar-Palomino, B., Michel-Morgin, J. E., & Lozano, M. S. (2018). First report of partial albinism in the blue lobster *Panulirus inflatus* (Bouvier, 1895) from the Mexican Pacific (Crustacea, Decapoda, Palinuridae). *ZooKeys*, 784, 1-6. <https://doi.org/10.3897/zookeys.784.25082>
- Leal, M. E., Schulz, U. H., Alborno, P. L., Machado, R., & Ott, P. H. (2013). First record of partial albinism in two catfish species of *Genidens* (Siluriformes: Ariidae) in an estuary of Southern Brazil. *Brazilian Archives of Biology and Technology*, 56(2), 237-240. <https://doi.org/10.1590/S1516-89132013000200008>
- Lin, C., Zhang, L., Liu, S., Gao, S., Xu, Q., & Yang, H. (2013). A comparison of the effects of light intensity on movement and growth of albino and normal sea cucumbers (*Apostichopus japonicus* Selenka). *Marine and Freshwater Behaviour and Physiology*, 46(6), 351-366. <https://doi.org/10.1080/10236244.2013.841350>
- Lin, J. Y., & Fisher, D. E. (2007). Melanocyte biology and skin pigmentation. *Nature*, 445(7130), 843-850. <https://doi.org/10.1038/nature05660>

- Muraoka, K., & Honma, H. (1993). Albino of the tanner crab, *Chionoecetes japonicus* Rathbun collected from Hokkaido. *Cancer*, 3, 23-25. https://doi.org/10.18988/cancer.3.0_23
- Nakamura, K., Ozaki, A., Akutsu, T., Iwai, K., Sakamoto, T., Yoshizaki, G., & Okamoto, N. (2001). Genetic mapping of the dominant albino locus in rainbow trout (*Oncorhynchus mykiss*). *Molecular Genetics and Genomics*, 265(4), 687-693. <https://doi.org/10.1007/s004380100464>
- Nakatani, I. (1999). An albino of the crayfish *Procambarus clarkii* (Decapoda: Cambaridae) and its offspring. *Journal of Crustacean Biology*, 19(2), 380-383. <https://doi.org/10.1163/193724099X00196>
- Nakatani, I. (2000). Reciprocal transplantation of leg tissue between albino and wild crayfish *Procambarus clarkii* (Decapoda: Cambaridae). *Journal of Crustacean Biology*, 20(3), 453-459. <https://doi.org/10.1163/20021975-99990059>
- Okamoto, K., & Misyuku, A. (1998). Molting and growth of the albino spiny lobster, *Panulirus japonicus* collected from Southern coast of Izu Peninsula, Shizuoka prefecture. *Cancer*, 7, 17-18. https://doi.org/10.18988/cancer.7.0_17
- Potterf, S. B., Furumura, M., Sviderskaya, E. V., Santis, C., Bennett, D. C., & Hearing, V. J. (1998). Normal tyrosine transport and abnormal tyrosinase routing in pink-eyed dilution melanocytes. *Experimental Cell Research*, 244(1), 319-326. <https://doi.org/10.1006/excr.1998.4173>
- Wang, J., Hou, L., Zhang, R., Zhao, X., Jiang, L., Sun, W., An, J., & Li, X. (2007). The tyrosinase gene family and albinism in fish. *Chinese Journal of Oceanology and Limnology*, 25(2), 191-198. <https://doi.org/10.1007/s00343-007-0191-9>
- Zhao, H. (2011). *Basic research on occurrence mechanism of albinism in sea cucumber *Apostichopus japonicus* (Selenka)*. [PhD Thesis. Graduate University of Chinese Academy of Science. Beijing, China].
- Zhao, H., Chen, M., & Yang, H. (2015). Albinism (pp. 211-228). In Yang, H., Hamel, J. -F., Mercier, A. (Eds.), *Developments in aquaculture and fisheries science: The sea cucumber *Apostichopus japonicus* history, biology and aquaculture*. Academic Press. <https://doi.org/10.1016/B978-0-12-799953-1.00012-X>