

An appendage abnormality in the first left pereopod of red swamp crayfish (*Procambarus clarkii*) reared in the laboratory conditions

Laboratuvar koşullarında yetiştirilen kırmızı bataklık kerevitinin (*Procambarus clarkii*) ilk sol yürüme bacağına bir uzantı anormalliği

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Received date: 28.05.2020

Accepted date: 05.11.2020

How to cite this paper:

Karadal, O. (2021). An appendage abnormality in the first left pereopod of red swamp crayfish (*Procambarus clarkii*) reared in the laboratory conditions. *Ege Journal of Fisheries and Aquatic Sciences*, 38(1), 107-109. DOI: [10.12714/egejfas.38.1.13](https://doi.org/10.12714/egejfas.38.1.13)

Abstract: Red swamp crayfish (*Procambarus clarkii*) is the most cultivated crayfish species in the world that has commercial importance for both aquaculture and aquarium industries. In this study, a case report of an appendage abnormality observed in the left cheliped of a female specimen (6.92 g) reared under laboratory conditions is presented. It has been determined that the specimen has two appendages in the left cheliped root. Of these appendages, the right one (1.27 cm) ends in a blunt. On the left (1.06 cm), a spiny structure similar to that of the fourth and fifth walking legs was observed.

Keywords: Cambaridae, external outgrowths, walking legs, cheliped, dactyl

Öz: Kırmızı bataklık kereviti (*Procambarus clarkii*), hem su ürünleri yetiştiriciliği hem de akvaryum sektörleri için ticari öneme sahip olan ve dünyada en fazla üretilen kerevit türüdür. Bu çalışmada, laboratuvar koşullarında yetiştirilen bir dişi bireyin (6,92 g) sol kısıracında gözlemlenen ekstremite anormalliği hakkında vaka takdimi sunulmuştur. Bireyin sol kıskaç kökünde iki uzantı olduğu tespit edilmiştir. Bu uzantılardan sağdaki (1,27 cm) küt bir şekilde sonlanmıştır. Soldakinde (1,06 cm) ise, dördüncü ve beşinci yürüme bacaklarındakine benzer dikenli bir yapı görülmüştür.

Anahtar kelimeler: Cambaridae, dış çıkıntılar, yürüme bacakları, kıskaç, daktıl

INTRODUCTION

Red swamp crayfish (*Procambarus clarkii*) is a highly resistant and tolerant freshwater species that may dwell a widespread of wetlands, marsh areas, stagnant rivers, and lakes. The crayfish is originated from the north-eastern region of Mexico and the Louisiana, United States. This species is the most cultured crayfish in the world (FAO, 2018) and it is valuable for both aquaculture and aquarium industries. The crayfish can tolerant extreme conditions, such as oxygen and temperature alterations, water pollution, and drought (Barbaresti and Gherardi, 2000; Cruz and Rebelo, 2007). This factor lead an importance in selectivity of this species in aquaculture. Negatively, invasiveness has been informed from North and South America, Europe, Asia, and Africa (GISD, 2015). In Turkey, the species introduced to aquarium sector in the last quarter of 2000's. Currently, there is no qualified red swamp crayfish cultivation in Turkey, but this crayfish exposed as one of the most common and popular species in the aquarium sector of Turkey.

The species has a dominant body colour as typically red, reddish brown or orange (Gherardi, 2011). It grows rapidly and adults can reach up to 15 cm in length, though optimum body length is 12 cm (Henttonen and Huner, 1999; Loureiro et al., 2015). Body of this species is mainly separated as

cephalothorax and abdomen (Hobbs, 1974). As all the crustacean decapods, red swamp crayfish have five pairs of walking legs (pereopods) beneath their cephalothorax. The first pairs of pereopods are specialized as big claws called cheliped. The second and third pairs of pereopods have small pincers which act as hold and handle. The fourth and fifth pairs have no structure like claw or pincer, whilst these pereopods have spines for walking and stabilizing. Different types of appendage abnormalities have been reported in previous studies (Nakatani et al., 1992, 1997, 1998; Murayama et al., 1994; Nakatani, 1996; Nakatani and Kitahara, 1999) on this species. In these studies, generally extra and lateral outgrowths on the chelipeds or other appendages have been reported.

In this case, an abnormality was observed in the left cheliped, which has branched structure of a specimen of red swamp crayfish and this situation was reported.

MATERIALS AND METHODS

Laboratory conditions and rearing system

The case was observed in Invertebrates Culture Laboratory, Faculty of Fisheries, İzmir Kâtip Çelebi University,

Çiğli, İzmir, Turkey. Red swamp crayfish (*Procambarus clarkii*) were obtained from a commercial facility and reared in the laboratory conditions. The crayfish were stocked into two recirculating freshwater sump systems (270 L in each) and fed twice daily with commercial bottom feed (Artakua®, Tire, İzmir, Turkey), routinely. The temperature in the systems was held at 25-26 °C with external heaters (Hydor ETH 300). Dissolved oxygen and pH were measured daily with AZ 84051 Combo Water Meter and their range were recorded as 8.70-9.50 ppm and 7.30-7.80, respectively.

General features of the crayfish specimen

Among the crayfish in the sump systems, a female specimen (Figure 1) was attentional. An appendage abnormality in the left cheliped was observed, whilst no anomaly was found in its other pereopods (walking legs) and pleopods (swimming legs). Then, the female was examined closely and recorded some body measurements (Table 1).

Specimen was weighed with an electronic balance (Kern PCB 2500-2, precision of ± 0.01) and total length (TL),

carapace length (CL), and carapace width (CW) were measured with a digimatic caliper.

Table 1. Some body measurements of the female specimen

	Measurement
Weight (g)	6.92
Total length (cm)	6.50
Carapace length (cm)	2.42
Carapace width (cm)	1.44

RESULTS

Details and measurements of abnormal appendage were shown in Figure 2. It has been observed that the base of the appendage (0.65 cm) emerged from the root of left cheliped and it branched elongated. The appendage has two branches: a taller in the right (1.27 cm) and a shorter-spiny in the left (1.06 cm). Taller branch has a one joint and two parts (0.70 and 0.57 cm). Shorter branch has a spine at its end (0.19 cm).



Figure 1. General view of the female red swamp crayfish (*Procambarus clarkii*) specimen

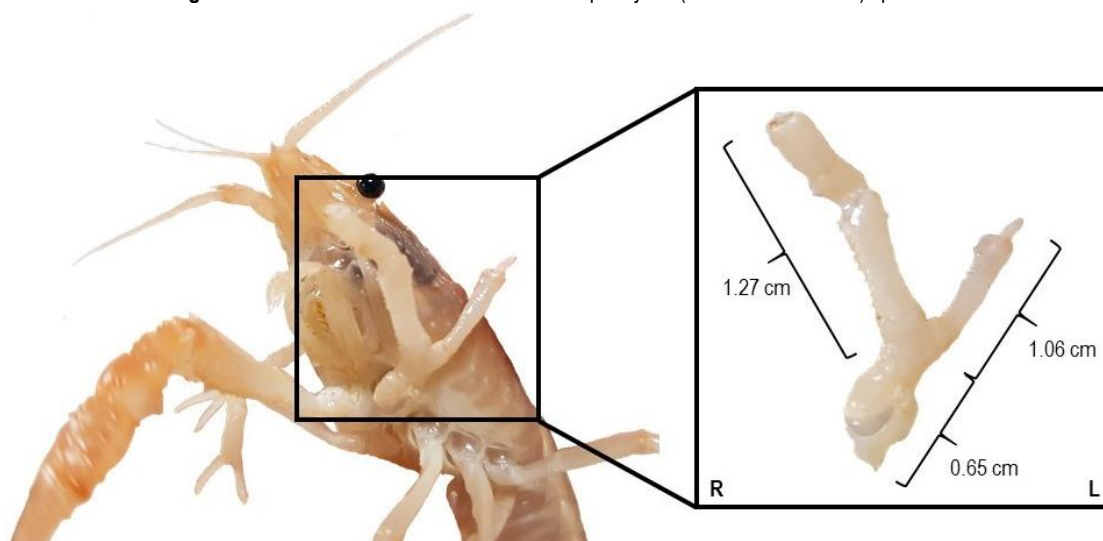


Figure 2. Detailed view and length measurements of the abnormal appendage onto the female red swamp crayfish (from dorsal view R: right, L: left)

DISCUSSION

The pereopods are five in number in the infraorder Astacidea and the first three pairs have claws (Crandall and Buhay, 2008). Though, in this case, the left cheliped of female specimen has an abnormality and no claw was existing. In previous studies, the authors reported lateral outgrowths from the chelipeds in naturally captured red swamp crayfish (Nakatani et al., 1992, 1997) and laboratory studies have resulted that this type of occurrence could be induced in this crayfish species by wounded healing (Murayama et al., 1994; Nakatani, 1996; Nakatani et al., 1998; Nakatani and Kitahara, 1999). In contrast, in this case, no claw has appeared, while two branched structures were recorded. Also, Nakatani et al. (1997) found an outcrop at the propodus of the left third pereopod and they stated that a dactylus was appeared at the next moult. Abnormal branched appendage existed from the basis of the left cheliped and no propodus and dactylus were formed in the current case. Rasheed et al. (2014) reported an existing propodus and dactylus in the fifth

pereopod (shaped like paddle) of blue swimming crab (*Portunus pelagicus*) and the authors declared that the cause of abnormality is an accident during moulting or regenerating.

In previous research, it has been stated that these abnormalities are the results of failing in healing of the wounds (Shelton et al., 1981; Nakatani et al., 1992; Nakatani, 1996; Mariappan et al., 2000). Nakatani et al. (1998) declared that various mechanisms led to cause of these kinds of outgrowths, extra claws or dactyls. The outgrowth may be related to the shape of the wound or to the period of the moulting during the moment of wounding. Failure in healing of wounds in some cases could explain with occurring of lateral outgrowths (Shelton et al., 1981; Murayama et al., 1994). Additionally, these abnormalities would result some disadvantages, such as to reduce the feeding efficiency, mating failure, and more vulnerable to external attacks (Juanes and Smith, 1995). Further studies are needed to research the causes and results of these abnormalities in detail.

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