**Infestation of brown shrimp, *Farfantepenaeus aztecus*, Ives (1891) (Penaeidae) by *Epipenaeon ingens*, Nobili (1906) (Isopoda, Bopyridae) from the Antalya Bay, Turkey**

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**SUMMARY**

In this study, a bopyrid isopod, *Epipenaeon ingens* Nobili (1906) infestation on brown shrimp, *Farfantepenaeus aztecus* Ives (1891) were studied. The shrimp samples were monthly collected from the eastern Mediterranean coast of Turkey from October 2012 through March 2013. A total of 70 *F. aztecus* samples carrying bopyrid isopods were obtained during whole sampling period. Total lengths and weights of female and male parasites were measured, recorded, and averaged. The isopod parasite was identified as *Epipenaeon ingens*. The average weight of infested females was 50.18 ± 2 g and the average length of them was 17.66 ± 2 cm. The average of infested males was 21.53 ± 2 g and the average length of them was 17.37 ± 2 cm. Infested female prevalence was 14.28 % at 17 TL and 17.85% at 18 TL. Infested male prevalence was 10.71 % at 17 TL and 7.4 % at 18 TL. Characteristic bulging on branchial chambers of the infested shrimp samples, where parasite attached was; however, changes related to the primary and /or secondary sexual organs of the examined shrimps were not determined. It is understood that *E. ingens* is increasing its penaeid host range.

**Keywords:** Brown shrimp, *Farfantepenaeus aztecus*, *Epipenaeon ingens*, Antalya Bay, Turkey.

**RESUMEN**

En este estudio, un isopodo bópyrido, *Epipenaeon ingens* Nobili (1906) infestación en camarón marrón, *Farfantepenaeus aztecus* Ives (1891) se estudió. Se recolectaron échantillons mensuales de camarones de la costa este del Mar Mediterráneo de Turquía desde Octubre de 2012 hasta Marzo de 2013. Se obtuvieron un total de 70 échantillons de camarones *F. aztecus* con isópodos bópyrid. El parasito fue identificado como *Epipenaeon ingens*. El promedio de peso de las hembras infestadas fue 50.18 ± 2 g y el promedio de largo de ellas fue 17.66 ± 2 cm. El promedio de peso de los machos infestados fue 21.53 ± 2 g y el promedio de largo de ellos fue 17.37 ± 2 cm. La prevalencia femenina infestada fue 14,28% en 17 TL y 17,85% en 18 TL. La prevalencia masculina infestada fue 10,71% en 17 TL y 7,4% en 18 TL. Característico bulging en las cámaras branchiales de los échantillons infestados camarones, donde el parasito se unió a; sin embargo, cambios relacionados con el primario y /o secundario órganos sexuales de los camarones examinados no fueron determinados. Se entiende que *E. ingens* está aumentando su gama de hospedadores.

**Claves:** Camarón marrón, *Farfantepenaeus aztecus*, *Epipenaeon ingens*, Bahía de Antalya, Turquía.

**Introduction**

Penaeid shrimps are important commodities in both fisheries and aquaculture production because of their economic value and abundance in estuarine and littoral ecosystems in many parts of the world [23, 24, 31]. Due to the above mentioned reasons, there are many studies on their biology [18, 20], ecology [36, 39], culture [1, 33], and diseases [13, 40]. Disease causes predation and periodic physical disasters in limiting numbers of shrimps in nature and is also another important factor limiting profitabilities in commercially production of them [8]. One of the diseases observing in penaeid shrimps is parasitic infestation. Infestations may be caused by various agents including protozoan parasites like *Zoothamnium* sp., *Vorticella* sp., *Epistyli* sp. [11], nematodes like *Microphallus* sp. and *Opecoeloides fimbriatus* species, *Contracaecum* sp. [18], *Thynnascaris* sp., *Spiracamallanus pereirai*, *Leptolaimus* sp. and *Croconema* sp. [8], cestodes like members of the genera *Prochristianella*, *Parachristianella* and *Renibulbus* [20, 34], and crustaceans like rhizocephalons and bopyrid parasites (e.g. *Epipenaeon ingens* and *Parapeneaon japonicum*) [3, 9]. Within isopods, family of Bopyridae (Rafinesque-Schmaltz, 1815) has nearly 600 described species worldwide and most of them are obligate and macroparasites of shrimps [3, 15, 29, 35]. They are also known as holoparasites and they attach themselves to the gills of shrimps [5, 32]. Owens and Rothlisberg [27] reported that understanding of the spreading capability of cryptoniscus larva, a infectious stage in the life cycle of bopyrid isopod was needed; thus, patch distributions of the adult bopyrid isopods could be understood. These authors [27] also informed that...
**Materials and Methods**

From October 2012 through March 2013, monthly samples were collected from in depths of 30-35 m of Antalya Bay (between Antalya and Serik), which is located in the eastern Mediterranean coast of Turkey. 

**SAMPLE COLLECTION**

From October 2012 through March 2013, monthly samples were collected from in depths of 30-35 m of Antalya Bay (between Antalya and Serik), which is located in the eastern Mediterranean coast of Turkey. 

**LABORATORY PROCEDURES**

Infested shrimps were distinguished by a noticeable bulge in the shrimp's carapace over the right branchial chamber. These samples were stored on ice and transported to the laboratory, where they were weighed and measured. The infested shrimps were identified to species level, females and males were sorted by visible thelycum or petesma according to the information reported by Pérez Farfante [31]. Their gill covers were cut away to reveal location of parasites and examined by using a streamicroscope. The infested the branchial chambers of the specimens were noted. After the parasites were separated from their host, the parasites were counted. Total lengths (TL) and weights of female and male parasites were measured, recorded, and averaged. The isopod parasite was identified as *Epipenaeon ingens* according to information given by Thomas [38] and Lalitha Devi [21]. Then parasites were preserved in 70% ethyl alcohol.

**Results**

The purpose of the present study was to inform on the occurrence of *Epipenaeon ingens* on a new host, *Farfantepenaeus aztecus*, which is non-native shrimp species for eastern Mediterranean Sea coastal of Turkey.
A total of 70 *F. aztecus* samples carrying bopyrid isopods were obtained during whole sampling period. There were no infested shrimps. Of 70 infested samples, 30 were males and 40 were females. The average weight of infested females was 50.18 ± 2 g and the average length of them was 17.66 ± 2 cm. The average of infested males was 21.53 ± 2 g and the average length of them was 17.37 ± 2 cm. Infested female prevalence was 14.28 % at 17 TL and 17.85 % at 18 TL. Infested male prevalence was 10.71 % at 17 TL and 7.4 % at 18 TL. Because of the large female parasite’s location on the host’s gills, it was observed that an abnormal discolored bulge underside of the right branchiostegite (gill cover) part of carapace section of the infested shrimp (Figure 2a). After removing gill cover of the infested shrimp, it was observed that the bopyrid pair consisted of one female parasite and one male parasite (Figure 2b). The male parasite attached to the pleon of female isopod (Figure 2c). When the isopod pair were collected from the gills, the infested shrimp’s gills were pale and it was also noticed a wide depression on the gills.

![Figure 2: Farfantepenaeus aztecus samples infested with Epipenaeon ingens (lateral view), (arrowed). 2 (b). After removing the gill cover, the bopyrid isopod pair were observed on the gills. 2 (c). The pair consisted of one male parasite and one female parasite (arrowed).](https://example.com/figure2.png)

**Figure 2:** Farfantepenaeus aztecus samples infested with Epipenaeon ingens (lateral view), (arrowed). 2 (b). After removing the gill cover, the bopyrid isopod pair were observed on the gills. 2 (c). The pair consisted of one male parasite and one female parasite (arrowed).

Description of the female and male specimens were given below.

*Description.*-Female (Figure 3A). The average weight of the 70 female parasites with eggs ranged from 0.93 g to 2.78 g. The average size of them ranged from 1.8 cm to 2.6 cm in length and 1.4 cm to 2.0 cm in width. Body oval, and discoidal in appearance, larger than broad. Body shape slightly asymmetrical, cream-coloured. Head embedded in pereon, and frontal lamina not well developed. Uropods are not covered by the 5th pairs of pleopods. Uropods are not placed in the centre and pleopods biramous. Five abdominal somites are visible dorsally.

Male (Figure 3B). The average size of 70 male parasites ranged from 0.8 cm to 1.0 cm in length and 0.1 cm to 0.3 cm in width. Head small and distinct from thorax. Head and pereomeres are separate. Body elongated twice as long as broad. Body colour is cream. Abdominal somites are completely fused to form a sub-triangular structure. Thoracic segments with deeply are notched lateral margin. Uropods and pleopods are absent.

![Figure 3: A: Female E. ingens isopod, B: male](https://example.com/figure3.png)

**Figure 3:** A: Female E. ingens isopod, B: male

**Discussion**

In this study *Epipenaeon ingens*, parasitic bopyrid isopod was found in the gills of wild shrimp *Farfantepenaeus aztecus* samples from the coast of Antalya Bay. According to Dall [10], parasitic isopods have not been reported from the Gulf and Atlantic coasts of North America but they commonly infest some penaeid species in the Indo-Pacific region including Gulf of Arabian, India, Hong-Kong, Australia and the Philippines. It was interesting that *E. ingens* has been reported in the other penaeid shrimps from the Red Sea, India, Hong-Kong, and Australia [7, 9, 15, 25, 26, 35, 37, 38], the parasite has never been reported from *F. aztecus* in Turkey and also other regions where the shrimp occurs naturally including west of the Mississippi River through Tamaulipas, Mexico [12]. Both *E. ingens* has not been reported from the Gulf and Atlantic coasts of North America and as reported by Rajkumar *et al.* [35] that *E. ingens* has occured mostly in the Indian and Western Pacific Oceans, it is assumed that there are two potential ways of the expansion of the parasite’s range in the eastern Mediterranean Sea. One of these ways is that the Suez Canal allows the expansion of the parasite’s range and another one is that *E. ingens* was introduced into the Mediterranean Sea by balast water of ships navigating the Suez Canal. Parasitic bopyrid isopods may cause castration effects such as inhibiting the maturation of the female gonad and feminizing parasitized males on their hosts [16] and/or they have some effects like degeneration of the sex organs on their hosts reported by some authors [16, 21]; however, these effects were not observed in the infested *F. aztecus* samples.
in this study. When the parasitized shrimps were examined, they seemed to be normally except a discolored characteristic bulge in their carapace and a wide depression on surface of the infested shrimp's gills. It was reported that infested penaeid shrimps continued to grow but their growth was affected by this state [10]; however, we could not compare status of infested F. aztecus growth because of lacking of detailed studies about biology of F. aztecus in the eastern Mediterranean coasts of Turkey and non-infested specimens were not caught in this study. Lalitha Devi [21] reported that total length range of female E. ingens was 1.08-2.01 cm and length of male parasite's body changed from 0.3 cm to 0.7 cm. Although species descriptions for E. ingens given by Thomas [38] and Lalitha Devi [21] agreed with our observations for female and male parasites, lengths of them in this study were larger than lengths of female and male E. ingens in the descriptions reported by Lalitha Devi [21]. As a conclusion, the present work is the first record of the parasite in the eastern Mediterranean coasts of Turkey and it is appeared that the parasite is increasing it's penaeid host range.

References

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