Clavellotis briani (Copepoda, Lernaeopodidae) Infestation on Striped Seabream, Lithognathus mormyrus (Sparidae) from the Northeast Mediterranean Sea, Turkey

Abstract
There is increasing interest in the striped sea bream, Lithognathus mormyrus (Linnaeus, 1758) as an alternative fish species in aquaculture in the Mediterranean region. This paper provided information on the infestation of species of Clavellotis briani Benmansour, et al. 2001 (Lernaeopodidae) collected from striped sea bream in Northeast Mediterranean Sea waters off the Turkish coast. A total of 234 fish were examined between May 2011 and April 2012 and female parasites were collected from the branchial arches of fish and identified. During a 12-month survey the prevalence was calculated as 3.4% for C. briani. The striped sea bream is known as an alternative culture species for Mersin Bay. This is the first report of Clavellotis briani in wild population of L. mormyrus from Mersin Bay and Turkish waters.

Key Words
Clavellotis briani, Lithognathus mormyrus, Northeast Mediterranean Coast, Turkey

Türkiye'nin Kuzeydoğu Akdeniz Kıyısından Çizgili Mercan (Lithognathus mormyrus: Sparidae) Balığında, Parazit Clavellotis briani (Copepoda, Lernaeopodidae) İnfestasyonu

Özet

**Anahtar Kelimeler**

*Clavellotis briani, Lithognathus mormyrus*, Kuzeydoğu Akdeniz Sahili, Türkiye

1. **Introduction**

The aquaculture industry has developed to such an extent that Turkey is currently the third largest finfish aquaculture producer (i.e. excluding shellfish) in Europe, and the second largest producer of sea bass, sea bream, and rainbow trout (after Norway). Furthermore, Turkey is in third place in terms of average annual percentage of growth rate in aquaculture production (FAO 2008). In recent years, great efforts have been made for the commercial production of alternative fish species particularly broodstock management, larval development, culture protocols and health status including striped seabream (*Lithognathus mormyrus*) in the Mediterranean region (Fırat et al 2005, Yavuzcan Yıldız 2008, Emre et al 2010). Some important bacterial, viral, and parasitic agents cause significant economic losses in cultured sea bass (*Dicentrachus labrax*),
seabream (*Sparus aurata*), and rainbow trout (*Oncorhynchus mykiss*) (Gene 2011). The control of fish parasites requires knowledge of the parasites, their hosts, and their prevalence and also distribution (Mitchum, 1995). Continuously, new parasites and hosts were reported from Turkey and all over the world. This information is considered valuable data for the aquaculturists and fish disease researchers (Gene 2011).

Fish disease outbreaks are an increasing threat to wildlife, intensified by increases in the human population and cultured animals (Macdonald and Laurenson 2006; Thirgood 2009; Price et al. 2010). The most common route of transmission to wildlife is from artificial reservoirs of host populations (McCallum and Dobson 1995; Daszak et al. 2000, Price et al. 2010).

Among the copepods that parasitize marine fish, the family of Lernaeopodidae includes 45 genera (Boxhsall 2013), some on teleost and others on elasmobranch fish. As is common in parasitic copepods, Lernaeopodidae display an unusual sexual differentiation. Only the female lernaepodid is attached as a parasite on the fish. The small male lives in temporary association, often on the body of its partner. The female generally presents characteristic attachment organs (Kabata 1979; Kabata 1990; Kabata 2004; Benkirane et al 1999).

Lernaeopodidae have been reported in cultured fish all over the world, including *Clavellotis fallax* (Heler 1965) on *Dentex dentex* from Malorco (Gonzalez 2005), *Clavellotis sargi* (Kurz 1877) on *Diplodus sargus* and *Diplodus vulgaris* from Tunisian coasts (Ben Hassine et al 1978), *Clavellotis strumosa* (Brian 1906) on the *Pagellus erythrinus* and *Lithognathus mormyrus* from Tunisian coasts (Benmansour et al 2001) *Clavellotis sebastidis* on *Sebastes oculatus* from Argentina (Castro & González 2005).
However there is no record in the literature for lernaeopodids that are parasitic on *Lithognathus mormyrus* in Turkey marine waters. The only lernaeopodids reported from Turkey waters *Clavellotis fallax* Heller 1868 on *Diplodus sargus sargus*, *Pagellus erythrinus*, *Sarpa salpa*, and *Spondyliosoma canthus* from the Aegean Sea (Akmirza 2000). Additionally as lernaeopodids; *Lernaeopoda galei* Krøyer 1837 on *Mustelus mustelus* from the Aegean Sea (Karaytug et al. 2004), *Neobrachiella impudica* Von Nordmann, 1832 on *Trigla lucerna* from the Sea of Marmara (Öktener & Trilles 2004a), *Eubrachiella exigua* Brian 1906 on *Pagellus erythrinus* from the Mediterranean Sea (Öktener & Trilles 2004b), *Neobrachiella bispinosa* Von Nordmann, 1832 on *Trigla lucerna* from the Mediterranean Sea (Öktener & Trilles 2004b), and also *Clavellotis strumosa* Brian 1906 was recorded on *Pagellus erythrinus* from the Sea of Marmara (Ökten 2008).

In the present study, *Clavellotis briani* (Benmansour et al. 2001) (Copepoda, Lernaeopodidae) was reported for the first time and identified on striped seabream, *Lithognathus mormyrus* (Teleostei, Sparidae) in the Mersin Bay (Northeast Mediterranean Sea), Turkish water.

### 2. Materials and Methods

The parasitological survey has been conducted to determine which parasitic copepods were present on teleost fish in Mersin Bay of Turkey since 2007. In 2011-2012 period striped seabream, *Lithognathus mormyrus* were caught monthly (May to April) by trammel nets in Mersin coast, located at 36.65°-36.8° N, 34.55°-34.8° E. After capture,
the fish were placed on ice for approximately 1-1.5 hrs. Total length and weight were recorded, and the body surface, fins, and mouth of each fish were examined. Parasites were collected from the upper gill arches of the infested striped seabream and immediately preserved in 70% ethyl alcohol. Specimens were cleared in lactic acid for 2 h prior to examination using an Olympus SZX16 dissecting microscope and Olympus BX51 compound microscope. Parasites specimens were photographed with a digital camera. Three females were kept in the collection of Prof. Raul Castro Romero (University of Antofagasta, Chile) and five adult females are deposited in the collection of Fisheries Faculty in Mersin University. Identification of Clavellotis briani was performed according to Brian (1924), Ben Hassine et al (1978), Kabata (1979), Castro & Baeza, (1984), Benkirane et al (1999), Benmansour et al (2001), and Boxshall (2013)’s reference literatures.

3. Results

Class: Copepoda Edwards, 1840,
Order: Siphonostomatoida Thorell, 1859
Family: Lernaeopodidae Olsson, 1869
Subfamily: Clavellinae Dana 1853
Genus: Clavellotis Castro & Baeza 1984

Clavellotis briani Benmansour et al 2001 (Figure 1)
Synonym: Clavellotis briani Benmansour et al 2001
Material examined: A total of 8 specimens, all, from gill arches of five individuals of *Lithognathus mormyrus* (Linnaeus 1758)

Infestation values: *Clavellotis briani* was recorded with a prevalence of 3.42% on striped seabream (8 out of 234 fish examined). The mean intensity of infestation for the population, the mean intensity per fish, and the minimum maximum parasite load per infested fish were: 3.42%; 1 and 1, respectively (Table 1).

Type locality: Coast of Mersin, Turkey.


Habitat: Branchial arches.

Measurements: Total length 3.5-4.0 mm, mean 3.8 mm (n = 8).

Geographical range: *Clavellotis briani* (Brian, 1906) is widely distributed in in the North Sea, Mediterranean Sea, Mauritania, Tunisia, Gulf of Lion in France, Kenitra in Morocco, and Dakar in Senegal (Brian 1906; Nuñes Ruivo 1954; Ben Hassine et al 1978; Benmansour & Ben Hassine 1997; Benkirane et al 1999).

Benmansour et al (2001) reported 18.2% infestation prevalence for *Clavellotis briani* on striped seabream. Other species of the genus *Clavellotis* have earlier been recorded by several other authors as well. Ben Hassine et al (1978) reported 4.5% infestation prevalence for *Clavellotis strumosa* on striped seabream. Ben Hassine et al (1978) determined 9% infestation prevalence for *Clavellotis sargi* on *Diplodus sargus*. Radujkovic & Raibaut (1989) reported a %19 infestation prevalence for *Clavellotis sargi* (Kurz, 1877) on *Diplodus annularis* in Montenegro, 1% on *Diplodus vulgaris*, 5.4% on *Diplodus annularis*, 27.7% prevalence on *Pagrus pagrus*, 6% on *Sarpa salpa*, and 0.9% *Pagellus erythrinus*. Öktener et al (2008) reported 6% infestation prevalence...
for *Clavellotis strumosa* on *Pagellus erythrinus*. Thus, the prevalence levels recorded in the present study are within the range reported in other studies.

4. **Discussion**

The only lernaeopodids previously reported from Turkish waters are *Clavellotis fallax* Heller, 1868 on *Diplodus sargus sargus*, *Pagellus erythrinus*, *Sarpa salpa*, and *Spondyliosoma cantharus* from the Aegean Sea (Akmirza 2000); *Lernaeopoda galei* Krøyer, 1837 on *Mustelus mustelus* from the Aegean Sea (Karaytug et al 2004); *Neobrachiella impudica* Von Nordmann, 1832 on *Trigla lucerna* from the Sea of Marmara (Öktener & Trilles 2004a); *Eubrachiella exigua* Brian, 1906 on *Pagellus erythrinus* from the Mediterranean (Öktener & Trilles 2004b); *Neobrachiella bispinosa* Von Nordmann, 1832 on *Trigla lucerna* from the Mediterranean (Öktener & Trilles 2004b) and *Clavellotis strumosa* (Brian, 1906) on *Pagellus erythrinus* from the Sea of Marmara (Öktener et al 2008).

5. **Conclusion**

Future studies should focus on collecting biological information to examine control procedures to reduce the *Clavellotis briani* infestations. Because the Mersin Bay is identified as a key site for cage aquaculture by the Turkish Ministry of Aquaculture and Rural Affairs, findings of the current study would serve a vital role for future aquacultural efforts in the area. In a global perspective, data provided herein might be considered significant to address maintenance of natural environments and thus create sustainable natural fish stocks and aquaculture development in near future. In conclusion, *Clavellotis briani* has not previously been reported from Turkey. The present record represents a northward extension of the known ranges of both the host and the parasite.
References


Figure 1. *Clavellotis briani* (Brian, 1906), female specimen (Scale: 1mm)
Table 1. The status of examined fishes (W: live weight, TL: total length)

<table>
<thead>
<tr>
<th></th>
<th>Number of examined fish</th>
<th>W (g)</th>
<th>TL (cm)</th>
<th>Number of parasitized fish</th>
<th>Prevalence (%)</th>
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<tbody>
<tr>
<td>May</td>
<td>11</td>
<td>122.33±13.3</td>
<td>19.89±0.90</td>
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<td>June</td>
<td>22</td>
<td>68.74±2.49</td>
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<tr>
<td>July</td>
<td>18</td>
<td>70.22±2.10</td>
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<td>74.57±3.87</td>
<td>17.22±0.29</td>
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<tr>
<td>September</td>
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<td>71.94±6.40</td>
<td>17.37±0.41</td>
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<tr>
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<td>64.99±3.48</td>
<td>17.08±0.28</td>
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<td>63.74±4.02</td>
<td>15.40±0.29</td>
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<td>10</td>
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<tr>
<td>Total</td>
<td>234</td>
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<td>-</td>
<td>40</td>
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<tr>
<td>Mean±SD</td>
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<td>79.11±17.54</td>
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<td>2.92±2.78</td>
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