

## RESEARCH ARTICLE

### **Prevalence of *Heterosaccus dollfusi* Boschma, 1960 (Rhizocephala: Sacculinidae) on *Charybdis longicollis* Leene, 1938 (Brachyura: Portunidae) from Iskenderun Bay, Turkey**

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#### **Abstract**

Surveys for parasitic barnacle, *Heterosaccus dollfusi* Boschma, 1960, on crab, *Charybdis longicollis* Leene, 1938, were conducted monthly between July 2002 and June 2003 along the coast of Iskenderun Bay. A total of 857 crab specimens were captured in 6 localities at different depths (4 to 50 m). Parasites were detected in the abdomen of 200 out of 425 females. Parasite infection rate among females was 47.6% whereas the rate was 23.31% for the total. Captured crabs ranged from 0.6 to 50.75 g (WW) in weight, while their carapace length varied between 19.2 and 67.3 mm (CL). The infected crabs varied from 2.1 to 24.3 g (WW) in weight and between 28.4 and 52.8mm (CL) in length.

**Keywords:** *Charybdis longicollis*, *Heterosaccus dollfusi*, alien species, host/parasite relationship, Levantine Sea

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#### **Introduction**

Rhizocephalans, parasitic barnacles, is a diverse taxon and they infect a number of crab species. Rhizocephalans change the morphology, physiology and behaviour of their hosts so that hosts become nothing but automatons serving only the purpose of the parasite (Høeg *et al.* 2005). Kuris (1974; 1997) suggested parasitic castrators, specifically rhizocephalan barnacles, may be important regulators of host population density, since they cause reproductive death to their hosts, and therefore, may be used as control agents for invasive marine decapod crustaceans.

The swimming crab, *Charybdis longicollis* Leene, 1938, was first recorded in the Mediterranean in 1954 from Mersin Bay, Turkey (Holthuis 1961). Since then, it has been recorded all along the Levantine coast, from Egypt to the Aegean coast of Turkey. It is known that *C. longicollis* are spread from Iskenderun Bay to Gökova Bay (Aegean Sea coast of Turkey) (Holthuis 1961; Kocatas 1981; Enzenros and Enzenros 1990; Özcan *et al.* 2005; Özcan 2007). The presence of the species at the Coast of Rhodes Island, situated between Aegean and Levantine Sea was also reported in 1986, 1997 and 1999 (Galil and Kevrekidis 2002).

Within the family Sacculinidae, the genus *Heterosaccus* is the third largest taxon consisting of 12 species that infest crabs throughout the world (Glenner *et al.* 2008). Alien rhizocephalan barnacle, *Heterosaccus dollfusi* Boschma, 1960, is a lessepsian migrant transported by its host *C. longicollis* (Galil and Lützen 1995). *H. dollfusi* was first recorded from the Israel coast (Galil and Lützen 1995) and the coast of southeastern Turkey, 1994 (Øksnebjerg *et al.* 1997) and is now well established (Galil and Lützen 1995; Galil and Innocenti 1999).

Of the thousands of specimens collected over three decades, none showed evidence of parasitism until 1992, when a few bore the sacculinid rhizocephalan *H. dollfusi* (Galil and Lützen 1995). Within three years *H. dollfusi* had spread as far as the eastern Anatolian coast (Øksnebjerg *et al.* 1997). The parasite affects the growth, morphology and behaviour of the host and castrates both male and female crabs. The infection rate in Haifa Bay rose to 77% in 1995. Yet, six years later in spite of high levels of infestation there is no noticeable reduction in the host population (Galil and Innocenti 1999).

Investigation of *H. dollfusi* in the Mediterranean Sea was studied in Israel (Galil and Lützen 1995; Galil and Lützen 1998; Galil and Innocenti 1999; Innocenti *et al.* 2009) and Turkey (Øksnebjerg *et al.* 1997; Innocenti *et al.* 2009). In Turkish coast, species have been reported from Iskenderun and Antalya Bay (Øksnebjerg *et al.* 1997; Innocenti *et al.* 2009). The aim of this study was to determine the prevalence of *H. dollfusi* on the invasive swimming crab *C. longicollis* in the Levantine Sea coast of Turkey and to observe differences between parasitized and non-parasitized individuals.

## **Material and Methods**

Crab specimens were caught from sandy-silt bottoms of Iskenderun Bay (southeastern coast of Turkey) from July 2002 to June 2003 (Figure 1). Samplings were conducted on board the R/V Mustafa Kemal-I at depths ranging from 4 to 50 m by bottom trawling. The trawl was equipped with 18 mm mesh size net at the cod-end. Hauling lasted about one hour at a towing speed of approximately 1.5 knots. A total of 72 trawl haulings were made during these

surveys. Specimens were fixed on board with formalin (5%) and later rinsed with freshwater and preserved in 70% ethyl alcohol.

Sex of all crabs was determined and measurements of carapace length (CL), carapace width (CW), and width of the fifth abdominal somite (ABW) were carried out using Vernier calipers to the nearest 0.1 mm. As well as infected individuals, the number and weight of parasites were calculated.

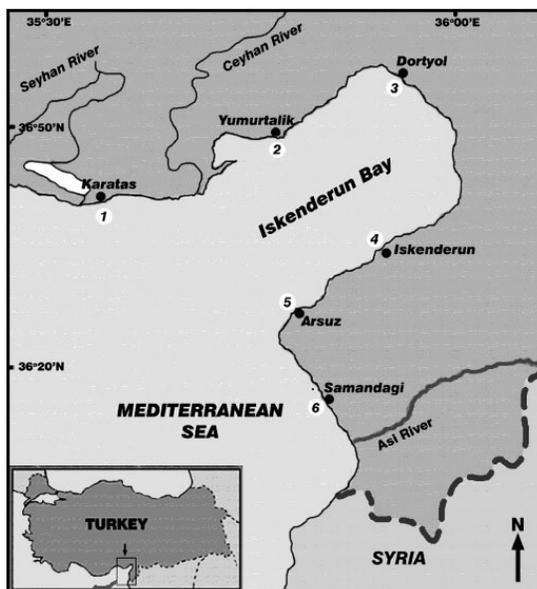


Figure 1. Map of the study area showing the sampling stations

## Results

A total of 857 *C. longicollis* (425 females and 432 males) were caught during the survey in Iskenderun Bay. The highest abundance of *C. longicollis* females were found around Station 2. Female crabs from this station represented 35.53% of total (Table 1). The highest abundance of infected females caught was from Station 2 (89) followed by Station 4 (53) and Station 1 (38).

Out of 425, 200 females were found to be infested. Occurrence of parasites on females was 47.6% while it was 23.31% among all the individuals. Out of 200 infected individuals, 188 (94%) had one single parasite in the abdomen while 8 (4%) had two parasites, 3 (1.5%) had three parasites and 1 (0.5%) had four parasites.

Infected individuals of *C. longicollis* were obtained all year around except February and March when the sampling was not possible due to bad weather

conditions. When it comes to monthly parasite abundance there was an increase in spring reaching to the peak value in July and August (34 specimens), and a decrease after August (Figure 2).

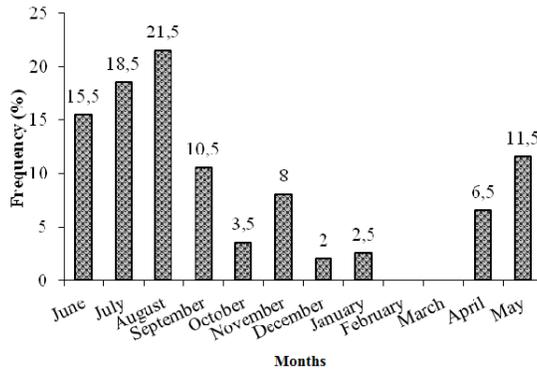
**Table 1.** The number of infected (I) and uninfected (UI) females individuals of *Charybdis longicollis* per station and month.

Months	Stations												Total (I/UI)
	1		2		3		4		5		6		
	I	UI	I	UI	I	UI	I	UI	I	UI	I	UI	
June	4	13	11	4	-	-	16	22	-	-	-	3	31/42
July	-	-	34	25	1	2	2	1	-	-	-	-	37/28
August	4	6	34	14	3	3	2	5	-	-	-	-	43/28
September	5	3	5	3	-	-	1	8	-	-	10	9	21/23
October	6	7	1	3	-	-	-	10	-	-	-	4	7/24
November	10	4	1	5	1	1	4	3	-	-	-	-	16/13
December	2	6	-	-	1	2	-	-	-	-	1	2	4/10
January	1	2	-	-	-	-	4	6	-	-	-	-	5/8
February	-	-	-	-	-	-	-	-	-	-	-	-	
March	-	-	-	-	-	-	-	-	-	-	-	-	
April	5	4	3	3	-	-	3	1	-	-	2	3	13/11
May	1	6	-	5	-	-	21	22	-	-	1	5	23/38

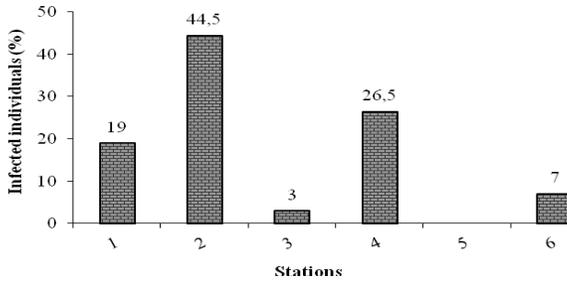
Regarding the distribution according to the stations within Iskenderun Bay, Station 2 (Yumurtalık) was determined to have the most abundant infected individuals. This was followed by Stations 4 and 1. No infected individual was obtained from Station 5 (Arsuz) (Figure 3).

Examination of the size (CW) frequency distribution of *C. longicollis* in Iskenderun Bay indicated that the largest number of crabs were between 30–45 mm wide, and many of the individuals in this size range were infected. Larger crabs (CW > 53 mm) were free of infestation.

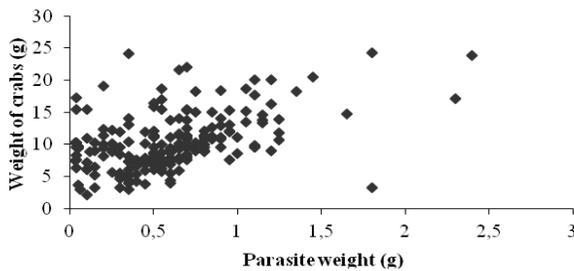
Carapace length (CL) of the smallest individual (female) caught was 19.2 mm (female) while the largest one was 67.3 mm (male). The smallest infested individual was 28.4 mm (CL) while the largest one was 52.8 mm. When it comes to weight of parasites, they ranged up to 2.4 g and the abundance was up to 1.5 g. As far as weight is concerned all the crabs have a distribution factor ranging from 2.1 to 24.3 g (WW) while this factor varied between 0.6 and 50.75 g among infested individuals (Figure 4).



**Figure 2.** The monthly proportion of the infected individuals of *Charybdis longicollis*.



**Figure 3.** Proportion of infected individuals of *Charybdis longicollis* at each station



**Figure 4.** The relationship between wet weight of infested *Charybdis longicollis* females and parasite weight

## Discussion

Thirty five of 39 crabs caught in 1995 spring between Fener Burnu and Karataş along Karataş coast were visibly infected (90%) (Øksnebjerg *et al.* 1997). The rate has become smaller along the coast of Iskenderun Bay (50-60%), while it occurs to be 0% between Karataş and Yumurtalık. Galil and Lützen (1995) found 55% of the males and 43% of the females collected in May from Israel coast were visibly infected.

Innocenti *et al.* (2009) reported that the crabs were infested by 62.8% in Palmahim (Israel) and by 19.4% in Antalya Bay (Turkey). It is possible that lower water temperature off Antalya (Turkey) may affect the timing of ontogenetic development of the parasite or the host, or increase the mortality of infected hosts, and hence, may result in drastic reduction of the occurrence of parasites.

According to Galil and Lützen (1998) the incidence of infection varied among the samples from an overall infection of 23.9 % in October 1993 and 37.6 % in November 1994, to 62.4% in May 1994. Multiple infections were much more common in spring than in fall. Thus, in the sample collected in May 1994, incidence of infestation was 62.4% and percentage of multiple infestations 52%, whereas in November 1994 the corresponding values were 37.6% and 23.5% (Galil and Lützen 1998). In October 1993 males constituted 55.7% of infected specimens at Palmahim, and prevalences were recorded 75.6% in November 1995 at Haifa Bay (Galil and Innocenti 1999).

The presence of *H. dollfusi* greatly modifies the morphology of its host, *C. longicollis* (Galil and Lützen 1995). Kuris (1997) stated "Theory as well as work on crustacean fisheries have shown that parasites with a direct effect on reproduction (parasitic castrators and symbiotic egg predators) could have a strong impact on host population dynamic and, thus on yield (Kuris 1974; Kuris *et al.* 1991; Lafferty 1993)".

The family Portunidae representing 35% of the total brachyuran crab species. *C. longicollis* was the most abundant (49.08% of the total individuals in trawl hauls) species in Iskenderun Bay (Özcan *et al.* 2005) and it is common on sandy-mud bottoms at 25–60 m and occasionally deeper, where it may form as much as 70% of the benthic biomass (Galil 1986).

It was pointed out in previous studies that parasites were detected in both males and females. However, they were only found on the abdomen of females in the present study. It appears that parasites occurrence rate along Israel coast is bigger than that along the Turkish coast. It is considered that the prevalence of parasites on the abdomen of females will have a serious impact on the population of the host species, however, recent study indicates that there is no

such correlation between the occurrence of the parasite and the abundance of the host since the number of individuals caught are relatively high to represent a declining population.

Introduction of parasites could have serious impacts on marine communities. More research is needed to discover exotic parasites and their effects on its host and further studies are required to better evaluation of the potential for safe and effective marine biological control. Moreover, researches should also be directed to find out if this parasite has invaded other native or exotic fauna.

## **İskenderun Körfezi'ndeki (Türkiye) *Charybdis longicollis* Leene, 1938 (Brachyura: Portunidae)'nin üzerindeki *Heterosaccus dollfusi* Boschma, 1960 (Rhizocephala:Sacculinidae)'nin yaygınlığı**

### **Özet**

*Charybdis longicollis* Leene, 1938 üzerindeki parazitik *Heterosaccus dollfusi* Boschma, 1960 üzerine yapılan bu araştırma Temmuz 2002 ve Haziran 2003 tarihleri arasında İskenderun Körfezi'nde gerçekleştirilmiştir. Toplam 857 yengeç bireyi farklı derinliklerdeki (4 ila 50 m) 6 lokaliteden elde edilmiştir. Parazitler 425 dişi bireyin 200'ün abdomeninden belirlendi. Dişiler arasındaki parazit enfekte oranı %47,6, halbuki tüm bireyler için aynı oran %23,31'dir. Yengeçlerin ağırlıkları 0.6 ile 50.75 g (WW) arasında iken karapas uzunlukları 19.2 ve 67.3 mm (CL) arasında değişim göstermiştir. Parazitle enfekte olmuş yengeçlerin ağırlıkları 2.1 ile 24.3 g (WW), karapas uzunlukları 28.4 ve 52.8 mm (CL) arasında değişim göstermiştir.

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