

**INVASIVE HOST, *CHARYBDIS LONGICOLLIS* (DECAPODA: BRACHYURA: PORTUNIDAE), AND  
INVASIVE PARASITE, *HETEROSACCUS DOLLFUSI* (CIRRIPIEDIA: RHIZOCEPHALA: SACCULINIDAE)**

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**Abstract**

The Levantine populations of Erythrean invasive swimming crab *Charybdis longicollis* have been parasitized by the rhizocephalan *Heterosaccus dollfusi*, itself an Erythrean alien, since 1992. The parasite affects the host morphology, moulting, behaviour, causes its sterilization, and induces mortality. The high prevalence of *H. dollfusi* can be ascribed to the dense population of the host, the year-round reproduction of the parasite that promotes recurrent re-infection. Despite the high prevalence of the parasite and its injurious impact on the host reproduction, the invasive host-parasite pair has reached an apparent *modus vivendi*.

**Keywords:** *Levantine Basin, Decapoda, Parasitism*

Instances of rhizocephalans accompanying their invasive hosts are few. Yet among the hundreds of alien species that have entered the Mediterranean through the Suez Canal such an invasive host-parasite pair was identified: the portunid crab *Charybdis longicollis* (Fig. 1) with its parasitic barnacle *Heterosaccus dollfusi* (Fig. 2).



Fig. 1. A male specimen of *Charybdis longicollis* Leene, 1938.

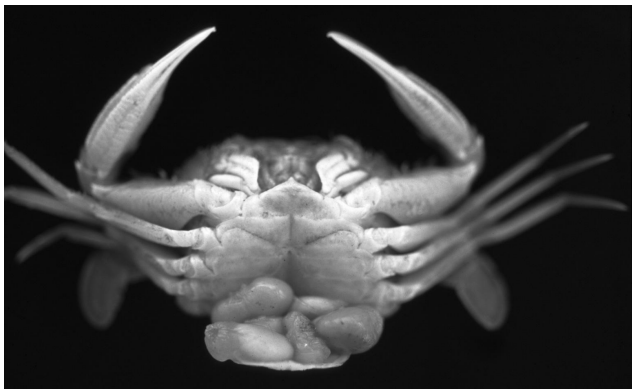


Fig. 2. *Charybdis longicollis* parasitized by 6 externa of *Heterosaccus dollfusi* Boschma, 1960.

A significant percentage of the host population along the Levant coast has been parasitized [1]. The parasite causes sterilization, morphological and behavioral feminization, cessation of molting and by placing high energetic demands on the host, induces mortality [2], [3]. Aspects of the biology, ethology and population dynamics of the invasive host-parasite pair along the Mediterranean coast of Israel have been studied since 1992. Nearly 19,000 crabs were examined, among these, over 10,000 were either externa-bearing, or internally-

parasitized morphologically-modified crabs. The incidence of parasitization has been high and fairly stable over the past 15 years. The number of specimens and the incidence of parasitization were higher in the spring (May-June) than in the fall samples (August-October). The abdomen of both sexes of infected *C. longicollis* is modified to such an extent that the sexual apertures remain the only reliable character. Infection of the females causes the loss of the swimmerets, whereas in males the copulatory appendages are lost or reduced, and the abdomen broadens to such a degree that it closely resembles that of an uninfected female. In post-parasitization host populations the average and maximal size of non-parasitized males is larger than parasitized males whereas average and maximal size of non-parasitized female crabs are smaller than those bearing externa. It is proposed that *H. dollfusi* may regulate the female host size to best endure the significant metabolic costs of the reproductive externa. Modifications of grooming, burying, courtship and mating, and agonistic behaviour have been observed in parasitized *C. longicollis*. The feminized agonistic behavior of male crabs parallels the feminization of the secondary sex characters and size range of *H. dollfusi*-parasitized *C. longicollis* (see above). It is also suggested that the presence of the parasite reduces belligerence in male crabs, enhancing injury avoidance [4]. Multiple parasitization has been common: nearly 40% of the externa-bearing hosts sampled between 1994 and 2009 harboured more than one externa, and over 17% bore three externa or more. The percentage of specimens bearing three or more externa is five times as high in spring as in fall samples. The pattern that emerges from the examination of the percentage of externa-bearing hosts bearing more than a single externa is that it increases when the incidence of parasitization rises above 50%. Almost without exception multiple externa occur among smaller crabs, presumably because they survive more poorly than single parasites. By placing an unacceptably high nutritional demand on the host, multiple externa weaken it and in many cases cause its untimely death.

**References**

- 1 - Innocenti G. and Galil B.S., 2007. *Modus vivendi*: invasive host/parasite relations - *Charybdis longicollis* Leene, 1938 (Brachyura: Portunidae) and *Heterosaccus dollfusi* Boschma, 1960 (Rhizocephala: Sacculinidae). *Hydrobiol.*, 590: 95-101.
- 2 - Galil B.S. and Lützen J., 1995. Biological observations on *Heterosaccus dollfusi* Boschma (Cirripedia: Rhizocephala), a parasite of *Charybdis longicollis* Leene (Decapoda: Brachyura), a lessepsian migrant to the Mediterranean. *J. Crust. Biol.*, 15: 659-670.
- 3 - Innocenti G., Vannini M. and Galil B.S., 1998. Notes on the behaviour of the portunid crab *Charybdis longicollis* Leene parasitized by the rhizocephalan *Heterosaccus dollfusi* Boschma. *J. Nat. Hist.*, 32: 1577-1585.
- 4 - Innocenti G., Pinter N. and Galil B.S., 2003. Observations on the agonistic behavior of the swimming crab *Charybdis longicollis* Leene infected by the rhizocephalan barnacle *Heterosaccus dollfusi* Boschma. *Canad. J. Zool.*, 81: 173-176.