

# *Briarosaccus callosis* - Parasitic Barnacle

## I. Causative Agent and Disease

*Briarosaccus callosus* is a parasitic barnacle belonging to the phylum Arthropoda, subphylum Crustacea, class Maxillopoda, subclass Thecostraca, infraclass Cirripedia (barnacles) and the superorder Rhizocephala (parasitic barnacles). Rhizocephalan barnacles are primarily parasites of decapod crustaceans but also occur in free-living barnacles and bivalve molluscs. They are noted for their invasiveness but general non-lethality in the natural host and endocrinological suppression of host fecundity at the population level.

## II. Host Species

*Briarosaccus callosus* is a cosmopolitan rhizocephalan parasitizing several species of lithodid crabs most notably from the southeast coast of North America, Antarctica and sub Antarctic areas, southwest Indian Ocean, the Bering Sea, the Gulf of Alaska, southeast Alaska and British Columbia, Canada. Known crab species parasitized by *B. callosus* in Alaska include the red, blue and golden king crabs.

## III. Clinical Signs

External clinical signs include a large orange/red sausage-shaped sac known as an externa that is attached by a stalk underneath the abdominal flap. The externa contains ova and/or larvae of the parasite. Radiating into the crab viscera from the externa is an emerald green dendritic mass or root system called the interna which largely replaces the hepatopancreas extending rootlets into all major organs and tissues of the visceral cavity including nerves and the bases of gills and muscle within the coxal joints. Gonads of both crab sexes are atrophied or absent. Parasitized male

crabs have an enlarged, raised abdominal flap and exaggerated growth of coxal setae. Histological examination confirms the extensive infiltration of tissues by the basophilic branching tubules of the rootlets generally causing no host inflammatory response. However, encapsulation of rootlets has been observed when the inflammatory response of the crab host is stimulated by a concurrent rickettsial infection.

## IV. Transmission

The complete life history of *B. callosus* is not known but a portion of larval biology has been established to allow analogy with other known rhizocephalans. The externa is a double cylinder with an internal chamber containing ova that move into the outer chamber as the embryos mature causing the externa color to become pale orange. Stage I nauplii released from the externa become planktonic during which successive molts occur to the final stage IV before molting into a cyprid. As with other rhizocephalans, these cyprids are presumed to be the infectious stage and are sexually dimorphic in that one externa may produce cyprids that are small and female while another produces larger male cyprids. The smaller female cyprids attach to the gill lamellae of a crab host and molt to the kentrogon stage which injects a cell mass through a hollow stylet. These cells proliferate in the crab host becoming the female interna and reproductive externa. Newly emerged virginal externa do not reach sexual maturity until fertilized by larger male cyprids to begin the cycle again.

## V. Diagnosis

Diagnosis is made by observation of the typical orange/red externa attached

by a stalk underneath the abdominal flap in lithodid crabs and the emerald green interna within the visceral mass. Parasitized crabs, including males, have feminized traits of an enlarged abdominal flap and a thick ventral growth of coxal setae, atrophied gonads and a protective behavior towards the attached externa. The externa utilizes hemoglobin as a respiratory pigment and bleeds red when damaged. Histological examination demonstrates the dendritic branches of the interna that retain the green pigment granules in fixed material.

**VI. Prognosis for Host**

Crabs are able to molt successfully with attached externa but the likelihood for long-term survival is not known once the parasite externa is lost or becomes senescent. Externa do not regenerate and the interna rootlets become atrophied

and necrotic causing an intense inflammatory foreign body response that may kill the crab host. The parasite alters the endocrinology of the host crab causing atrophy of the gonads (castration) in both sexes and suppressed growth which effectively limit recruitment. The negative impact of this parasite on a population scale may be significant in certain areas depending on prevalences which have varied in southeast Alaska from less than 1% in red king crabs, 20% in golden king crabs and up to 76% in blue king crabs.

**VII. Human Health Significance**

There are no zoonotic human health concerns regarding parasitism of king crabs by *Briarosaccus callosus*. However, the rootlets may cause green discoloration of knuckle meats despite cooking.

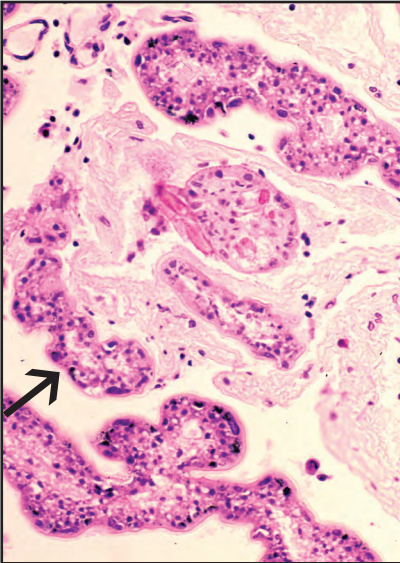


Dual parasitism of red king crab by *Briarosaccus callosus* showing viable externa (orange) and second senescent externa that has become necrotic (arrow)

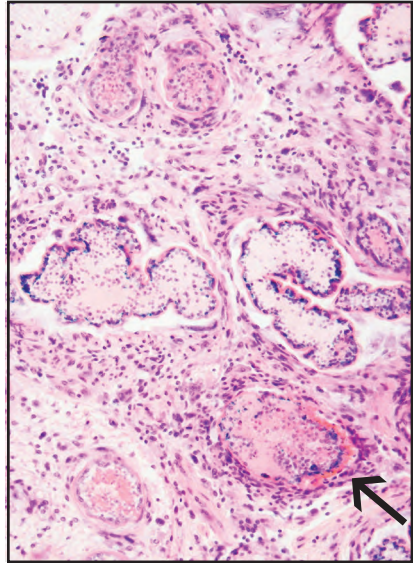


Cyprid larva of *Briarosaccus callosus* from the externa of parasitized blue king crab

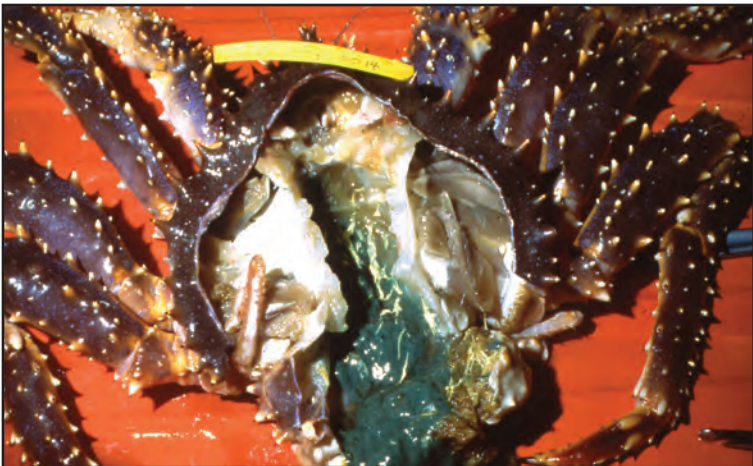
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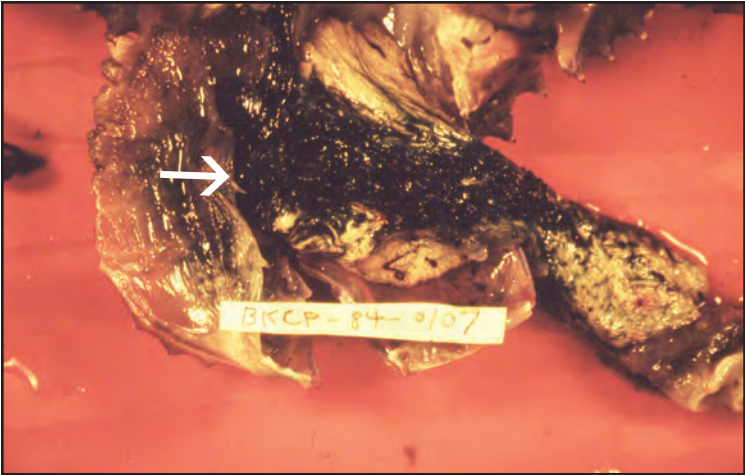
Histological section of blue king crab thoracic ganglion invaded by *Briarosaccus callosus* rootlets (arrow) of the interna with no host inflammatory response



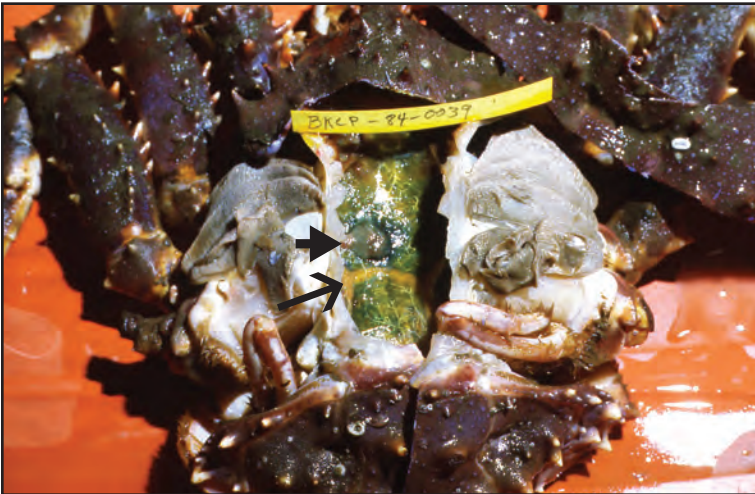
Histological section of *Briarosaccus callosus* in another blue king crab infected with a rickettsia-like organism showing encapsulation of rootlets (arrow) by host cells



*Briarosaccus callosus* in blue king crab with typical green rootlet mass from healthy parasite externa



Parasitized blue king crab with missing externa resulting in black, atrophied and necrotic internal rootlet mass (arrow)



Blue king crab parasitized by *Briarosaccus callosus* showing atrophied yellow ovary (arrow) and obvious green rootlets of the interna in the hepatopancreas; compare with normal ovary on next page; note coagulated hemolymph nodule (arrowhead) resulting from concurrent infestation by the ciliate, *Mesanophrys* sp.