

The development of myxozoan parasites in freshwater bryozoans, with reference to salmonid proliferative kidney disease

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Proliferative kidney disease (PKD) is well recognised as being a highly significant parasitic disease of salmonid fish, posing a high financial burden on the aquaculture sector. Primarily affecting first season freshwater salmonid fish (but also occurring in anadromous stocks following marine transfer), PKD has become endemic in areas of Western Europe and North America. The causative agent involved was originally known as PK‘X’, denoting its uncertain taxonomic position. Subsequent studies revealed that freshwater invertebrates of the phylum Bryozoa (Fig. 1) - known colloquially as “moss animals” - acted as alternate hosts, and the organism was eventually named *Tetracapsuloides bryosalmonae* and placed in the new class Malacosporea within the phylum Myxozoa.



Figure 1: Part of a bryozoan colony

In the current study, bryozoan colonies were collected from PKD-affected trout farms. Laboratory culture techniques were developed to allow continuous maintenance of these hosts of the parasite. Two myxozoan parasites were observed in the bryozoans:

Buddenbrockia sp. and *T. bryosalmonae*. Light & electron microscopy techniques were used to identify the developmental stages of both parasites. *Buddenbrockia* formed elongated worm-like spore sacs while *T. bryosalmonae* developed spherical sacs. Pathological changes were observed in bryozoans infected with each parasite. Whereas experimental exposure of rainbow trout to *T. bryosalmonae* material led to the development of PKD, a fish host for *Buddenbrockia* sp. has not yet been identified. Horizontal transfer of infection between bryozoan colonies was not demonstrated despite cohabitation trials and transfer of material between colonies using micro-manipulation injection techniques. These findings support the hypothesis that other organisms are required to complete the life cycles of these parasites.

The successful laboratory culture of infected bryozoan colonies is crucial in furthering our understanding of PKD. The translucent nature of bryozoans provides a unique opportunity for long-term study of myxozoan development directly within static natural hosts. The year-round maintenance of *T. bryosalmonae* could allow controlled infection models to be developed without relying upon seasonally available material. As such, the discovery of missing links in the life cycle is important. Hopefully, increased knowledge of the dynamics involved between pathogen and hosts could lead to development of successful prevention or control measures against this highly damaging disease.