

## *X-cell disease in common dab (*Limanda limanda* L.) caused by *Xcellia lamelliphila* (Perkinsea)*

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# ICES IDENTIFICATION LEAFLETS FOR DISEASES AND PARASITES OF FISH AND SHELLFISH

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## X-cell disease in common dab (*Limanda limanda* L.) caused by *Xcellia lamelliphila* (Perkinsea)

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# X-cell disease in common dab (*Limanda limanda* L.) caused by *Xcellia lamelliphila* (Perkinsea)

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## Susceptible species

The common dab *Limanda limanda* L.

## Disease name

Historically, this condition in dab has been known as 'X-cell disease' for several decades, the nature of the cells associated with the disease was unknown. It has now been established that the aetiological agent is closely related to Perkinsids. Morphologically similar X - cells have been reported in epidermal lesions in flatfish from North America and Japan as well as causing pseudobranchial growths (originally referred to as 'tumours') in gadoids, which comprise of parasitic cells in a connective tissue stroma.

## Aetiological agent

It has now been established that dab X-cells belong to a new taxon within the Perkinsea, namely the species *Xcellia lamelliphila* (Freeman, 2009; Freeman *et al.*, 2017).

## Geographical distribution

*X. lamelliphila* is usually found in dab at low prevalence in the North Sea and off the northwest of Scotland, where prevalences of up to 60% have been recorded (Diamant and McVicar, 1989). It has also been occasionally detected in dab from the Irish Sea and the English Channel (Bignell and Feist, unpublished). It has not been found in more northerly populations of dab. Two further infections with effectively identical SSU rRNA gene sequences to *X. lamelliphila* (GenBank Accession EU878172) have been recorded from *Lycodes reticulatus* (eelpout) off Iceland and from *Trematomus bernacchii* (icefish) in the Antarctic (Evans and Tupmongsol, 2014). Further work is required to determine whether all three belong to the same species. Therefore *X. lamelliphila* may have a very wide global distribution with the potential to infect a range of fish hosts.

## Associated environmental conditions

No specific environmental conditions conducive for infection and development in the host have been identified. Lack of information on life cycle requirements, transmission stages and involvement of alternate/paratenic/definitive hosts is currently lacking. Distribution of infective stages will be dependent on the presence of environmental conditions required by these hosts.

## Significance

The parasite causes serious disease in dab, which in severe cases results in near total replacement of the gill respiratory epithelium. As such, gaseous exchange is minimized and the host is highly susceptible to additional environmental or biological stressors including concomitant infections and disseminated infection in the host (Diamant and McVicar, 1987). Fish with branchial lesions have been shown to have reduced condition factor and impaired gonadal development (Knust and Dethlefsen, 1986). Gill lesions generally appear in fish of approximately 2-years of age and the prevalence declines in

older fish (Knust and Dethlefsen, 1986). However, it is possible that covert infections may be present in juveniles. In contrast, Freeman *et al.* (2017) reported that related parasites were particularly common in juvenile fish. In the development of the ICES Fish Disease Index (FDI) for assessment of fish health in marine monitoring programmes, the condition was considered 'likely to result in mortality'.

#### Gross clinical signs

In severe infections affected gills appear pale with swollen primary lamellae (Figure 1). Occasionally, the swollen gill filaments prevent complete closure of the overlying operculum and may protrude slightly.

#### Control measures and legislation

The disease affected wild populations and as such, no control measures are available. Not notifiable to OIE.

#### Diagnostic methods

In dab, clinical signs are pathognomonic. In relatively mild cases, histological sections show the presence of typical sub-epithelial parasitic cells, usually located at the base of the secondary lamellae (Figure 2) and in severe infections, with proliferation of cells distally until the entire lamella is occupied. Internal organs may also harbour parasites. Ultrastructural examination reveals the presence of characteristic cells with a large central nucleus and prominent nucleolus. Rarely, bi-nucleate stages indicative, of cell division, have been reported (Diamant and McVicar, 1989) have been reported. The cytoplasm contains numerous vesicles, smooth endoplasmic reticulum, as well as numerous, evenly dispersed electron-dense inclusions of unknown function (Figures 3, 4, and 5). Confirmation of identity is by SSU rDNA sequencing (Freeman *et al.*, 2017).

#### Key references

- Diamant, A. and McVicar, A. H. (1987) The effect of internal and external X-cell lesions on common dab, *Limanda limanda* L. Aquaculture, 67, 127-133.
- Diamant, A. and McVicar, A. H. (1989) Distribution of X-cell disease in common dab, *Limanda limanda* L., in the North Sea, and ultrastructural observations of previously undescribed developmental stages. J. Fish Dis., 12, 25-37.
- Evans, C. and Tupmongkol, K. (2014) X-cell disease in Antarctic fishes. Polar Biol., 37, 1261-1269.
- Freeman, M. A., Fuss, J., Kristmundsson, Á., Bjorbækmo, M. F. M., Mangot, J-F., del Campo, J., Keeling, P.J., Shalchian-Tabrizi, K and Bass, D. (2017) X-Cells Are Globally Distributed, Genetically Divergent Fish Parasites Related to Perkinsids and Dinoflagellates. Curr. Biol., 27(11), 1645-1651.
- Freeman, M. A. (2009) X-cell parasites in the European dab *Limanda limanda* are related to other X-cell organisms: a discussion on the potential identity of this new group of parasites. Parasitology, 136, 967-980.
- Knust, R. and Dethlefsen, V. (1986) X-cells in the gills of North Sea dab (*Limanda limanda* L.), epizootiology and impact on condition. Archiv für Fischereiwissenschaft 37, 11-24.
- McVicar, A. H., Bucke, D., Watermann, B and Dethlefsen, V. (1987) Gill X-cell lesions of dab *Limanda limanda* L. in the southern North Sea. Dis. Aquat. Org. 2, 197-204.



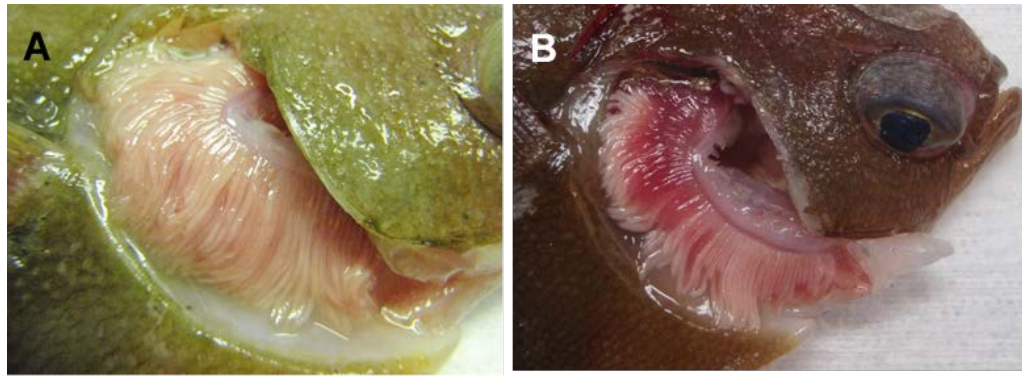


Figure 1. Gross clinical appearance of dab gill infected with *Xcellia lamelliphila*. A – severely infected gill with all lamellae showing swelling and pale colouration. B – less intense case where although all lamellae appear infected, several still retain regions remain well vascularised



Figure 2. Histological section showing multiple cells of *Xcellia lamelliphila* occupying a basal location between the secondary lamellae of the gill (\*). Haematoxylin and eosin. Bar = 50 µm.

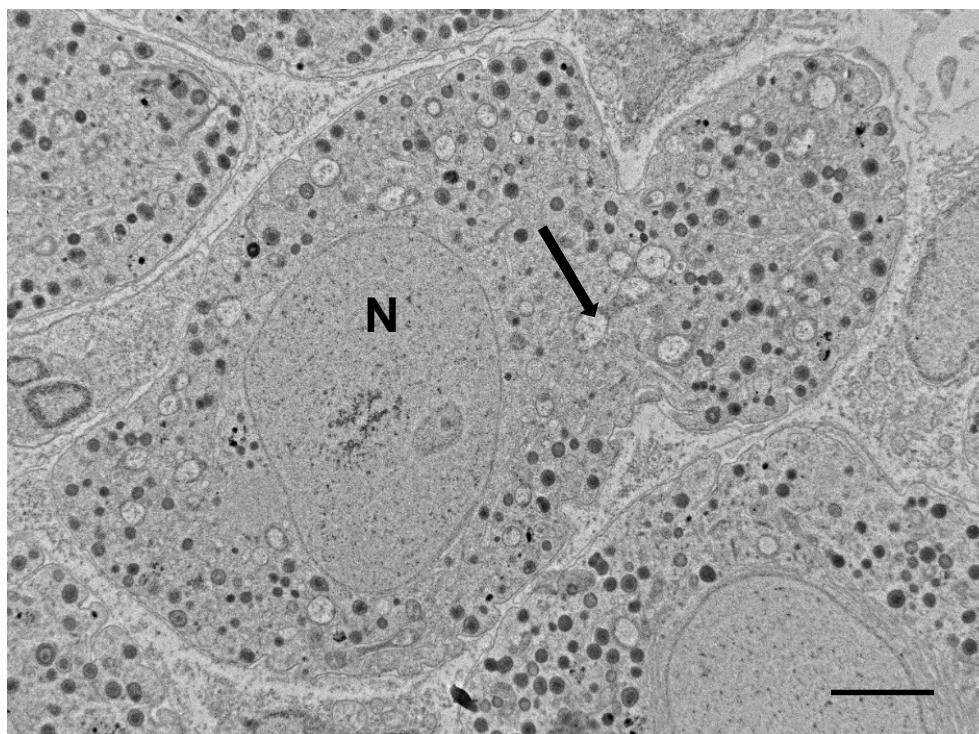


Figure 3. Ultrastructure of *Xcellia lamelliphila*. A – Parasite cell containing a prominent nucleus (N) with sparse chromatin and in regions corrugations of the cell surface. Numerous electron-dense inclusions of variable size, mitochondria (arrow) and a reticular network are also present. Bar = 2 $\mu$ m.

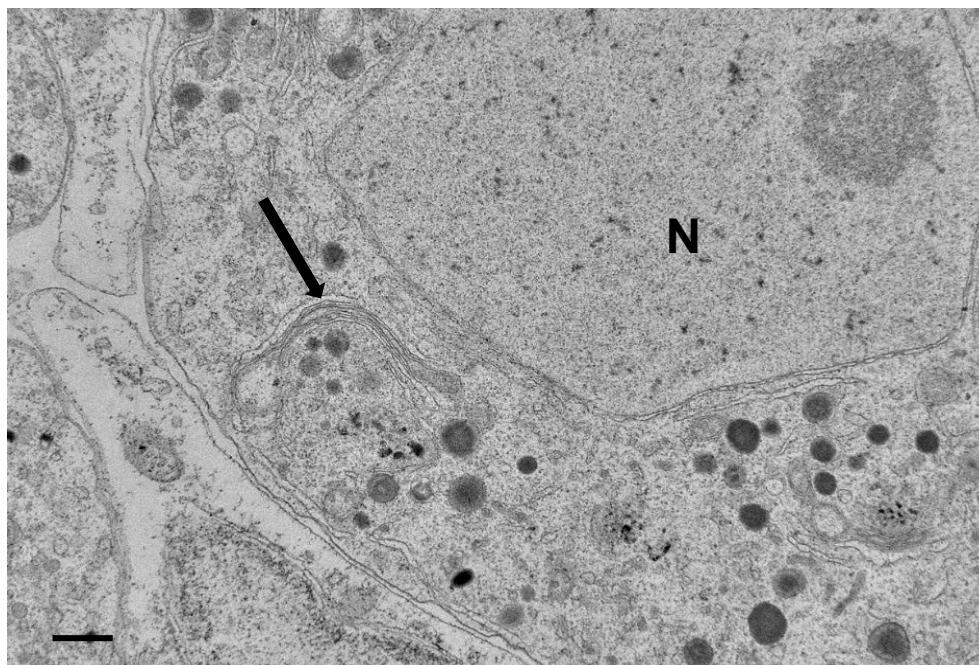
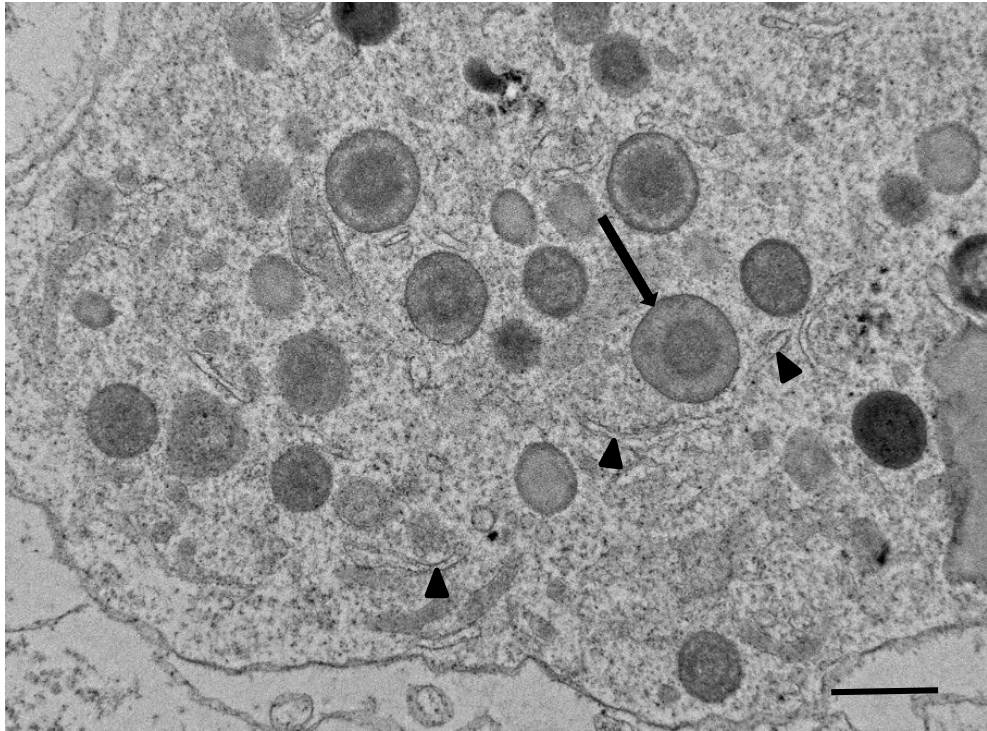


Figure 4. Detail of *Xcellia lamelliphila* cell cytoplasm showing the presence of Golgi apparatus (arrow) apparently associated with the production of the electron-dense inclusion bodies. The Nucleus (N) contains a prominent nucleolus. Bar = 500 nm





**Figure 5.** Larger inclusion bodies show a distinct structure and are membrane bound (arrow). The cell cytoplasm also contains strands of smooth endoplasmic reticulum (arrowheads). Bar = 500 nm.

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