

## Epizootic Ulcerative Syndrome

### Summary

Epizootic ulcerative syndrome (EUS) is a seasonal epizootic condition of wild and farmed, fresh- and brackishwater fish. Of complex infectious aetiology, it is characterized by the presence of invasive *Aphanomyces* infection and necrotising ulcerative lesions typically producing a granulomatous response. The disease is now endemic in South-east and south Asia, and has recently extended to West Asia. EUS is indistinguishable from red spot disease of eastern Australia and mycotic granulomatosis of Japan.

EUS has been reported to occur in over 100 freshwater fish species and, to a lesser extent, in brackishwater fish. It is more prevalent in snakeheads and barbs, while Chinese carps are rarely affected, and tilapias seem to be resistant. The primary causative agent of EUS appears to be one or more members of the fungal genus *Aphanomyces*. Isolates from EUS-infected fish in South-east and south Asia have recently been described as *Aphanomyces invaderis*, while in Japan, *A. piscicida* was described as the primary cause of mycotic granulomatosis. Recent studies have shown that these two species are indistinguishable culturally and pathogenically, and will probably prove to be con-specific. Additionally, the opportunistic bacteria *Aeromonas hydrophila* and *A. sobria* and one or more of a number of viruses may also be involved in the pathogenesis of EUS.

Diagnosis is based on clinical signs and histological evidence of the typical aggressive invasiveness of the non-septate fungal hyphae, within the context of high mortality. Isolation of the fungus allows its characteristic growth profile to be used as an aid to identification.

Control of EUS in natural waters is probably impossible. In outbreaks occurring in small, closed water bodies, liming of water and improvement of water quality, together with removal of infected fish, is often effective in reducing mortality.

### Introduction

Epizootic ulcerative syndrome (EUS) is a seasonal epizootic condition of great importance in wild and farmed fresh- and brackishwater fish. EUS is now considered to be indistinguishable from red spot disease which was first observed in eastern Australia in 1972, and from mycotic granulomatosis, which was first reported in Japan in 1971. EUS has extended its range through Papua New Guinea into South-east and south Asia, and most recently, into west Asia, where it has now reached Pakistan.

The most probably causative agent of EUS is the fungus *Aphanomyces invaderis* (*A. piscicida* in Japan), which causes severe liquefactive necrosis of muscle tissue as it invades the body; in some cases the hyphae extend into the visceral organs<sup>1</sup>. Infected fish

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<sup>1</sup> The relationship between *Aphanomyces invaderis* and *A. piscicida* has not yet been resolved. If the two species are eventually determined to be con-specific, *A. invaderis* Willoughby, Roberts and Chinabut, 1995, will become a junior synonym of *A. piscicida* Hatai, 1980.

usually also suffer from severe bacterial septicaemia involving a range of opportunistic pathogens – *Aeromonas hydrophila* and *A. sobria* being isolated most often. A variety of parasites have also been reported from diseased fish, but their presence is inconsistent. Associated viral infections also occur frequently. The fungus, by itself, cannot normally invade fish and it is postulated that some co-factor, such as epidermal damage (which may be initiated by an array of agents), severe environmental stress, or viral infection, is required to initiate this complex and exceedingly important condition.

Over 100 freshwater fish species and a number of brackishwater fish are susceptible to EUS. Snakeheads and barbs are particularly susceptible, while Chinese carps are rarely affected, and tilapias seem to be resistant.

### **Clinical Signs and Pathology**

The initial sign is usually mass mortality associated with distinct dermal lesions including ulcers. Surviving fish typically have lesions of varying degrees of severity. These may appear as red-spots, blackish burn-like marks, or deeper ulcers with red centres and white rims. Some fish, especially snakeheads survive a long time with such ulcers, which may erode so deeply as to expose the vertebrae, brain and viscera.

Histological occurrences include necrotising, granulomatous dermatitis and myoositis associated with invasive, non-septate fungal hyphae, 10-20 um in diameter. The fungus may penetrate visceral organs, such as the kidney and liver, after it has spanned the musculature.

### **Diagnosis**

Diagnosis is based on clinical signs and histopathology. No specific diagnostic tests are currently available.

The fungus can be isolated and cultured without difficulty, provided measures are taken to exclude bacterial and other fungal contaminants. Besides their typical vulnerability to temperature above 30°C, *A. invaderis* and *A. piscicida* are very similar to non-pathogenic opportunistic *Aphanomyces* spp. that readily contaminate the surface of affected fish and often interfere with isolation attempts. In the laboratory, the fungus has also been shown to be pathogenic to a wide range of fish, inducing similar pathology and mortality under various predisposing experimental conditions.

### **Control**

Control of EUS in wild populations is probably impossible. However, in small closed water bodies, mortality can be reduced by liming water and improvement of water quality, together with removal of infected fish.

**Source:** Chapter 3.1.5 – Epizootic ulcerative syndrome – OIE Diagnostic Manual for Aquatic Animal Diseases. 1997. Second edition.

**EUS** is listed by OIE under the category of ‘Other Significant Diseases’ – diseases which are of current or potential international significance in aquaculture but have not been included in the list of diseases notifiable to the OIE because of factors related to their importance or geographical distribution, or current knowledge of them or lack of approved diagnostic methods.

### **Other Information about EUS**

*Available estimates of economic losses due to EUS:*

Thailand (1983-1993):	US\$ 100 M
Bangladesh (1988-1989):	US\$ 4.8 M
Indonesia (1980-1987):	US\$ 235 000
Pakistan (1996):	US\$ 300 000
Eastern Australia (annually):	US\$ 700 000

### *Asia-Pacific Quarterly Aquatic Animal Disease Reporting System*

10 countries (Australia, Bangladesh, Cambodia, India, Indonesia, Lao PDR, Malaysia, Nepal, Philippines and Thailand) reported EUS during the reporting period July-September 1998, October-December 1998 and January-March 1999.

### *OIE Reference Laboratory for EUS*

The Aquatic Animal Health Research Institute (AAHRI) of the Department of Fisheries has been designated by OIE as the Reference Laboratory for OIE beginning January 1999.

### *Aetiology of EUS*

The pathogenic *Aphanomyces* has been reported under various names such as *Aphanomyces piscicida* (Hatai, 1980), *Aphanomyces invaderis* (Willoughby et al. 1995) and ERA (EUS-related *Aphanomyces* sp. (Lumanlan-Mayo et al. 1997). The Index of Fungi (1997) renamed *Aphanomyces invaderis* to *A. invadans* and in 1998 indicated that *A. invadans* is the only valid name.

### *Useful Reference and Contact Persons:*

(a) JH Lilley, RB Callinan, S Chinabut, S. Kanchanakhan, IH MacRae and MJ Phillips. 1998. Epizootic Ulcerative Syndrome (EUS) Technical Handbook . The Aquatic Animal Health Research Institute, Bangkok, 88 pp.

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**Highly susceptible freshwater species: goby, gourami, snakehead (Philippine specimens)**



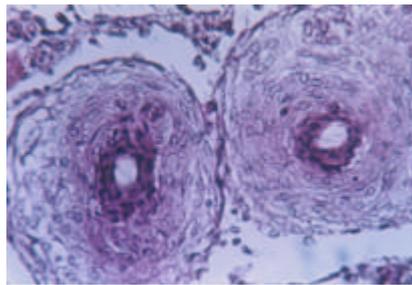
**Susceptible brackishwater species: Mullet (Australia (right) and Philippines (left))**



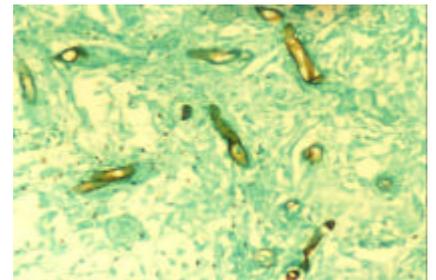
**Experimentally infected goldfish (Japan)**



**Histopathology: necrotising, granulomatous dermatitis and myositis associated with non-septate fungal hyphae**



**Grocott's silver stain showing fungal hyphae**



**Smear preparation of EUS fungus showing typical *Aphanomyces* sporangia (Philippine isolates)**

