Aphanomyces astaci 简体中文 正體中文

System: Freshwater

Kingdom	Phylum	Class	Order	Family
Fungi	Myxomycota	Phycomycota	Saprolegniales	Saprolegniaceae

Common name Wasserschimmel (German), crayfish plague (English)

Synonym

Similar species *Aphanomyces invadans, Aphanomyces meridionalis, Aphanomyces piscicida, Aphanomyces stellatus*

Summary Aphanomyces astaci commonly referred to as crayfish plague is an oomycete or water mould that infects only crayfish species. It is endemic of North America and is carried by North American crayfish species; signal crayfish *Pacifastacus leniusculus*, *Procambarus clarkii* and *Orconectes limosus*. *A. astaci* was introduced into Europe through imports of North American species of crayfish. Native European crayfish populations are not resistant to this oomycete. It has since devastated native crayfish stocks throughout the continent.

view this species on IUCN Red List

Species Description
Black melanized spots may be indicative of the presence of the crayfish plague (Persson and Söderhäll, 1983; Vey *et al.* 1983; Diéguez-Uribeondo and Söderhäll, 1993; Nylund and Westman, 2000). Identification of *A. astaci* requires microscopic examination of the affected tissues (Cerenius *et al.* 1987). Behavioural abnormalities, such as the phenomenon of 'walking on stilts', in which infected crayfish stand on the tips of their walking legs, is not necessarily indicative of an infected specimen.
Research shows that chitinase is expressed at a high level during vegetative growth of the crayfish pathogen (Andersson and Cerenius, 2002). Andersson and Cerenius (2002) state that \"The pattern of chitinase expression is one of very few qualitative physiological characteristics known which can distinguish *A. astaci* from other parasitic and saprophytic species and may thus be of practical use for identification.\"
Oidtmann *et al.* (2002) developed a method which allows identification of *A. astaci* by means of PCR and restriction enzyme analysis from pure fungal cultures. Recently, Oidtmann *et al.* (2004) developed a molecular method for diagnosis of *A. astaci* in clinical samples based on internal transcribed sequences of the ribosomal DNA.

Notes
Ways of transmission only involves movements of chronic carriers, i.e. North American crayfish, or infected crayfish (Söderhäll and Cerenius, 1999). The chances of transmission by other means such as items that have been in contact with contaminated water, fish or birds are very low and can only occur during the short period of survival of the *Aphanomyces* spores, i.e. a few days.

Habitat Description
Aphanomyces astaci is an oomycete or water mould, which only parasitises freshwater crayfish (Unestam, 1969). Co-evolution might have led to different (ecological) genetic variants (Diéguez-Uribeondo *et al.* 1995). At least three different species of North American crayfish have been shown to carry this water mould in their cuticle: *Pacifastacus leniusculus* (Söderhäll *et al.* 1981; Smith and Söderhäll, 1986), *Orconectes limosus* (Vey *et al.* 1987), and *Procambarus clarkii* (Diéguez- Uribeondo and Söderhäll, 1993, Diéguez-Uribeondo *et al.* 1995). These crayfish are known to be responsible for the transmission of crayfish plague, *A. astaci*, to the European species of crayfish: noble crayfish (see *Astacus astacus* in IUCN Red List of Threatened Species), white-clawed crayfish (see *Austropotamobius pallipes* in IUCN Red List of Threatened Species), and *A. leptodactylus* (Huang *et al.* 1994, Lilley *et al.* 1997; Vennestrom *et al.* 1998;Oidtmann *et al.* 1999; Diéguez-Uribeondo and Söderhäll, 1999).

Reproduction
Aphanomyces astaci belongs to the order Saprolegniales. Reproduction among the Saprolegniales can be asexual and sexual. The order Saprolegniales is characterised by the production of biflagellate zoospores during asexual reproduction. Genera of saprolegnian fungi are distinguished by their asexual reproductive apparatus, features of zoosporangium production and the mode of zoospore release (Jong *et al.* 1991). *Aphanomyces* species are characterised by zoosporangia of the same diameter-like vegetative hyphae. The spores encyst at the sporangium tip after leaving the zoosporangium and form primary spore aggregates (the spore balls). From these, the secondary free-swimming zoospores emerge, which are the infective stage of the oomycete.\"
Oidtmann *et al.* (2002) states that, \"*A. astaci* is an exception in the genus *Aphanomyces* in that it does not reproduce sexually. But as sexual reproduction can be induced only inconsistently in other *Aphanomyces sp.* in culture, the absence of sexual structures is not a reliable indication of *A. astaci*.\"

General Impacts
The infection process usually starts on the soft unsclerotised cuticle under the abdomen (Unestam, 1973). Hyphae grow in the soft, non-calcified parts of the cuticle. the mycelia grow rapidly through the cuticle and reach the internal body cavity, which, in European crayfish species, results in crayfish death within 6-10 days (Unestam and Weiss, 1970; Unestam, 1972; Alderman *et al.* 1987). However, in North American species the oomycete elicits a strong defence reaction immediately upon penetration of the cuticle (Unestam and Weiss, 1970). Hyphae extend into the water and produce motile zoospores which infect other crayfish. The first sign of crayfish plague mortality may be the presence of crayfish at large during daylight hours (crayfish are normally nocturnal), some of which may show evident loss of coordination in their movements and easily fall over on their backs and are unable to right themselves. Often, however, unless waters are carefully observed, the first recognition that there is a problem will be the presence of large numbers of dead crayfish in a river or lake (Alderman *et al.* 1987).\"
A. astaci has devastated European crayfish populations causing substantial economic losses to previously valuable fisheries (Diéguez-Uribeondo *et al.* 1997; Alonso *et al.* 2000; Westman and Savolainen, 2001). Resistant North American crayfish species have been introduced in an attempt to revive crayfish fisheries but research now shows that these species are having detrimental impacts on the remaining native crayfish species (Holdich, 1996; Diéguez-Uribeondo *et al.* 1997; Josefsson, 1999, *et al.* 2000). Because of the increased distribution of *A. astaci*, it poses a significant risk to plague free countries and continents (CEFAS, UNDATED).

Management Info
For details on preventative measures, chemical, physical, cultural and biological control options, please see *management information*.

Principal source: Oidtmann *et al.* 2002. *Identification of the crayfish plague, Aphanomyces astaci, by polymerase chain reaction and restriction enzyme analysis* and CEFAS, UNDATED *Crayfish Plague: Summary Final Rreport*.

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ALIEN RANGE

[1] AUSTRIA
[1] CANADA
[1] FRANCE
[1] GREECE
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[1] LITHUANIA
[5] NORWAY
[1] PORTUGAL
[1] SPAIN
[1] SWITZERLAND
[2] UNITED KINGDOM
[2] BELGIUM
[4] FINLAND
[1] GERMANY
[4] IRELAND
[1] LATVIA
[1] MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF
[2] POLAND
[1] RUSSIAN FEDERATION
[1] SWEDEN
[1] TURKEY
[1] UNITED STATES

Red List assessed species 7: EN = 3; DD = 3; LC = 1;

Astacoides betsileoensis **EN**
Astacus leptodactylus **LC**
Austropotamobius torrentium **DD**
Cambaroides schrenckii **DD**
Astacoides caldwelli **EN**
Austropotamobius pallipes **EN**
Cambaroides dauricus **DD**

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