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Aphanomyces astaci

Taxonomic status

Scientific name	Aphanomyces astaci (Schikora)
Family	Saprolegniaceae
Taxonomic group	Oomycetes
English name	Crayfish plague
German name	Krebspest
French name	Peste de l'écrevisse
Italian name	

Description and identification

Description	Diagnosis of crayfish plague requires the isolation of the fungus and its growth on agar for subsequent identification. The identification to genus depends on sporangial morphology and to species on the morphology of the sexual reproductive stages. However, a reliable sign of a crayfish plague infestation is a large number of dead crayfish in a given water system without mortality of other aquatic organisms.
Similar species	There is no other disease with such a high mortality rate in a crayfish population.

Biology and ecology

Behaviour	Zoospores actively swim with their two flagellae in search of a crayfish. When they locate one, they burrow into the skin and build a cyst. Whilst they are encapsulated in North American crayfish species, the European crayfish species have no effective defence reaction against the invader. The fungus grows inside the crayfish attacking all kind of tissues, including the nerves, which leads to abnormalities in behaviour, such as diurnal activity.
Food	Hosts are crayfish species; the European species have no effective defence mechanism.
Habitat	Crayfish species.
Origin	North America

Introduction and dispersal

History of introduction	The crayfish plague was introduced into Europe with North American crayfish in about 1860. The most likely pathway was in North American crayfish transported in ballast water to Lombardia/Italy.
Pathways of introduction	Intra-continental transport of the crayfish plague is via movement of their North American hosts and also via new imports from North America. The North American crayfish species are attacked by the fungus, but the disease does not develop, since the cysts are encapsulated within the carapace. However, they carry and spread the fungus, so that their occurrence is a great threat to native crayfish populations. The release of crayfish for farming and nowadays from aquariums is probably the most effective way for the crayfish plague to spread around Europe. Crayfish are a very successful farm product, and they escape from time to time.
Dispersal	The natural dispersal stage are the zoospores. They swim actively for about 5 days, but they can be transported longer distances on fishing equipment and animals (birds and mammals).

Current status

Actual and potential distribution in CH	The crayfish plague is widely distributed in Switzerland.
Introduced distribution	The entire European continent seems to be invaded by the crayfish plague and it is probably still carried around on live crayfish shipments.

Impacts

Environmental impact	The crayfish plague is an exceptional disease, because 100% mortality is the norm. Entire susceptible populations are wiped out by the infection. The rather small populations of native crayfish species are at high risk of extinction due to the alien disease and its carrier, the North American crayfish species. The introduction of the crayfish plague to Europe was an absolute disaster for the native crayfish species, which were already under threat from habitat destruction, overfishing, and water pollution. Interestingly, no adaptation and resistance to the fungus has taken place in the few decades since its introduction to Europe. This might be attributed to the fact that in most cases 100% mortality occurs. Larger populations of native crayfish species can survive only in isolated water bodies, but even there the threat of introduction of the disease is high. The fungus can be easily transported to them by animals, as mentioned above, or be introduced by aquarium releases.
Economic impact	The native crayfish populations were drastically reduced due to the invading alien disease, so that the industry had to use North American species. Some 3,300 tonnes of alien crayfish are imported into Europe every year to satisfy the growing demand of the market. This, of course, worsened the situation for the native crayfish species. In conclusion, the economic losses caused by the crayfish plague in Europe are enormous.
Management options	Management of infested watersheds is practically impossible and the disease kills very rapidly, so that measures would be too late in most cases. The European crayfish species die within 2 weeks of attack. Only the prevention of all introductions of crayfish to natural waters and into enclosed water bodies from which they may escape could be an effective measure to manage the threat posed by crayfish plague. However, equipment and water can also carry the disease. All potentially infested equipment should therefore be left to dry before being used in a new water body. Awareness raising with respect to releases of any pets (e.g. from aquariums) is a crucial tool in management of IAS.
Information gaps	Effective prevention.

References

Literature	Frutiger, A. and R. Müller (2002) Der rote Sumpfkrebs im Schübelweiher (Gemeinde Küssnacht ZH). Auswertung der Massnahmen 1998-2001 und Erkenntnisse. EAWAG, Dübendorf, 29 pp. Voglmayr, H. and Krisai-Greilhuber, I. (2002) Pilze. In: Essl, F. and W. Rabitsch (eds) Neobiota in Österreich. Umweltbundesamt, Wien, pp. 214-221. Westman, K. (2002) Alien crayfish in Europe: negative and positive impacts and interactions with native crayfish. In: Leppaekoski, E., Gollasch, S. and S. Olenin (eds) Invasive aquatic species in Europe, Kluwer, pp. 76-95. Williamson, M. (1996) Biological invasions. Chapman & Hall, London, Weinhaim, New York, Tokyo, Melbourne, Madras, 244 pp.
Other source	*http://www.oie.int/esp/normes/fmanual/a_00053.htm* Office international des épizooties (OIE) information page on the crayfish plague.