ROUNDTABLE SESSION 3A

PROTECTION OF NATIVES IN A PLAGUE SITUATION.

L. CERENIUS (Sweden), P. LAURENT (France), L. EDSMAN (Sweden)

The purpose of this roundtable was to discuss means of protecting native crayfish in a situation where plague is around. It was however felt that the scope should be broadened to include possible effects also of other pathogens such as viruses in conjunction with the plague. Also other parameters such as stress inflicted upon the animals by pollutants need to be considered when the effect of pathogens on crayfish is to be assessed.

Other pathogens and interactions with the plague *e.g.* viruses

Although the crayfish plague has been well studied very little is known about possible interactions with other pathogens. Viruses and bacteria for example are frequently encountered in crayfish, but their possible roles in disease development are virtually unknown. Especially, the effects of a co-existence of several putative pathogenic organisms within the same host crayfish are something, which should be addressed. It may be conjectured that an animal, which has to cope with several pathogens, will have an impaired immune capacity. This has been experimentally established in some cases such as for *Psorospermium haeckeli* and the crayfish plague fungus in *Pacifastacus leniusculus*. Animals harbouring the crayfish plague fungus are more susceptible to *P. haeckeli* infections than healthy animals. Although not studied in detail yet it seems likely that the presence of viruses will influence the outcome of an infection by for example the plague.

Variations in resistance and possibilities of breeding

The susceptibility to the plague varies both between different so-called susceptible species (*Astacus leptodactylus* being to some degree less susceptible to crayfish plague than *Astacus astacus* for example) and more importantly between individuals of the same species. Consequently, breeding with respect to disease resistance is possible and may be an alternative for aquaculture in some areas. In theory it seems evident that naturally existing variations in resistance towards specific pathogens and/or possibly general disease resistance, should be possible to explore in breeding programmes. The restrictions for such a programme are at present economical, biologically it is feasible.

Practical tests to fight the plague needed and easy to carry out

Very few attempts to test treatments of plague-infected animals with different fungicides (or more properly anti-oomycete compounds) have been carried out. Today the only method to remove the parasite is to remove the host since *A. astaci* does not survive without a crayfish host. Taken into the consideration a continuous further spread of exotic crayfish and thus crayfish plague in Europe it seems urgent that such studies are carried out. Such studies are relatively easily managed and can gain from the experiences made in developing compounds to combat oomycetes (mainly *Phytophthora*, *Peronospora* and *Pythium*) in agriculture. Other drugs used to fight off parasites and fungi in other systems should also be tested.

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Molecular diagnosis now possible

A large number of crayfish plague-like oomycetes are easily isolated from live and dead crayfish. These commensals and opportunistic parasites rarely cause any serious problems for the animal but they make diagnosis and isolation of the crayfish plague more difficult. Thus, diagnosis has been cumbersome and requires the isolation of the fungus for re-infection trials. The inability or perhaps sometimes the unwillingness to carry out a careful diagnosis has lead to that crayfish mortalities sometimes have been attributed to the crayfish plague without proper proof. One may speculate that such improper diagnosis also has lead to that bacterial and viral diseases in crayfish may have escaped attention. However, molecular diagnosis by the use of species-specific PCR-primers in crayfish tissues is now possible. Thus, in the near future diagnosis of crayfish plague may be achieved in a similar manner as is now standard for example when diagnosing viral diseases in shrimps. Still, in order to genotype the crayfish plague strain and elucidate patterns of dissemination pure cultures are required.

Survival times of crayfish plague spores and fungus

The crayfish plague fungus does not survive for any extended periods of time outside its host. This is because the parasite in its mycelial life cycle phase can not compete with other oomycetes or bacteria that have adapted to a saprophytic mode of life. The spores, the swimming zoospores and the encysted form, are ephemeral stages adapted for search for and renewed infection of the host. They normally live for 1-2 days but may survive for 1-2 weeks at low temperatures. The spores may encyst and reform zoospores a couple of times if unable to localise a new host animal but this ability is also lost within a few days since stored material within the spore cell are needed for the zoospore release and subsequent encystments. The consequence is that once the plague has wiped out a population of susceptible crayfish the parasite quickly vanishes. However, it is advisable to let one year elapse before any attempts to restock the water with new crayfish are made since crayfish individuals may escape attention for some time and thus the plague fungus may still be present. It is a prerequisite for a successful reintroduction of native crayfish that it has been ascertained that the *complete* previous crayfish population is gone.

Obtain information about the importance of health status and pollutants for disease resistance

It was brought up for discussion that the effects on health status of pollutants and other environmental factors are likely to influence the spread of pathogens. There are very few data on how parasite prevalence is influenced by environmental changes caused by human activities. However, it is well known by laboratory experiment that in crayfish as in all other animals, that the immune capacity is lowered by any environmental factor that inflict stress upon the animal. A complicating factor could though be that also spread of infective propagules of a parasite (*e.g.* zoospores) is extremely sensitive to many pollutants. In general one may safely assume however that pathogens more easily survive in a host weakened by large changes in the environment.