– ABSTRACT –

The crayfish plague pathogen, *Aphanomyces astaci,* is responsible for substantial declines and local extinctions of native European crayfish populations. As a consequence, the pathogen is now listed among 100 world's worst invasive alien species. The spread of *A. astaci* is greatly facilitated by its natural hosts, North American crayfish, that thanks to a long co-evolutionary history with the crayfish plague pathogen evolved efficient defence mechanisms. In contrast, European, Australian and Asian crayfish species are highly susceptible to this disease agent. However, progress of *A. astaci* infection in native European crayfish was observed to differ between distinct pathogen strains, indicating variability in their virulence. Indeed, we demonstrated a relationship between patterns in crayfish immune response and *A. astaci* virulence in an experimental infection involving the European noble crayfish and three differently virulent crayfish plague strains.

The European continent is currently inhabited by at least eight North American crayfish species. The carrier status was confirmed in six of them, including also *Orconectes* cf. *virilis* occurring in the Netherlands and the UK. In this country, we detected *Aphanomyces astaci* presence in some populations of the non-indigenous crayfish species as well as in individuals of the introduced catadromous crab, with the observed variation in pathogen prevalence among hosts linked to their introduction history and coexistence. Moreover, owing to aquaculture and stocking to open waters, several North American crayfish species established populations also on other continents as, e.g., *Procambarus clarkii* and *Pacifastacus leniusculus* in Japan. Therefore, as happened in Europe, they may pose a threat to endemic crayfish diversity. As the first such case, we confirmed the crayfish plague infection in Japanese populations of both crayfish species, indicating that *A. astaci* may have contributed to declines of the Japanese endemic crayfish *Cambaroides japonicus*.

The trade in ornamental crayfish species is nowadays a very popular hobby. Unfortunately, its rapid growth coincides in Europe with exotic crayfish releases to open waters. Our screening for *A. astaci* presence in various non-European crayfish species available for sale in Germany and the Czech Republic confirmed that aquarium trade may represent a source of crayfish plague pathogen (as well as other crustacean diseases), and hence may contribute to *A. astaci* spread to the natural environment with crayfish released from home aquaria. Furthermore, the crayfish plague pathogen may be also transmitted horizontally within shop facilities to presumably uninfected crayfish species, such as the parthenogenetically reproducing marbled crayfish. This widely traded crayfish taxon has been introduced to open waters in several European countries, including Slovakia where its recent expansion has been documented. Although I have not detected *A. astaci* in any of the three studied Slovak populations, the marbled crayfish might acquire the infection from the North American crayfish species encountered during its expansion.

Even ornamental crayfish of non-American origin may contribute to crayfish plague spread, if popular and widely available species exhibit elevated resistance. Experimental infection of the Australian *Cherax destructor* with *A. astaci* indeed indicated its decreased susceptibility, in comparison to European noble crayfish. Thus, *C. destructor* releases may result in formation of new pathogen reservoirs. Moreover, recently reported *A. astaci* infection in two crab species raised concerns that freshwater shrimps may also facilitate crayfish plague transmission to susceptible hosts. Although laboratory experiments with two ornamental Asian shrimp species revealed their resistance to *A. astaci*, pathogen growth was observed in some individuals and exuviae. Therefore, their potential to act as *A. astaci* vectors warrants further evaluation.