

Increases in transplantation surgery procedures, numbers of immunocompromised patients, cases of HIV infection and the need for chemotherapy have resulted in a dramatic rise in incidence of human mycosis over the past few decades. Therefore there is a pressing need to develop new antifungal agents. As infection most commonly occurs by inhalation of conidia and/or skin penetration by invasive hyphae, the key to understanding the infection strategies adopted by mycoses, and developing treatments, may well lay in the composition of conidia and hyphae particularly the enzymes and mycotoxins playing crucial role in the fungal infection progress.

Some species of pathogenic fungi infect both humans and insects, allowing research on insect models that are much cheaper and do not generate ethical problems. One such fungus is the cosmopolitan soil fungus *Conidiobolus coronatus* (Entomophthorales) known to cause mycoses (conidiobolomycosis) in a broad spectrum of mammals and insects. *C. coronatus* has also gained increasing interest as a potential biocontrol agent of insect pests due to highly selective action: it kills susceptible insect species rapidly and efficiently, leaving resistant species unharmed.

Although insects and mammals have evolved different defense systems against fungal invaders, in both cases the infection is initiated by fungal conidia and invasive hyphae, which overcome the host protective barriers (insect cuticle, mammalian skin) by enzymatic degradation of their major components (proteins, sugars and lipids).

Susceptible insect hosts are infected via cuticle penetration by invasive hyphae formed after the germination of the spores on the cuticle. Penetration is achieved by the enzymatic degradation of major cuticle components (proteins, chitin and lipids) by fungus proteases, chitinases and lipases. Upon invasion of the host hemocoel, hyphae expand but do not infest internal organs due to rapid host death caused by toxic metabolites of the fungus which disorganize functioning of excretion and immune systems.

The susceptibility or resistance of various insect species to *C. coronatus* invasion results from several factors: the structure of the insect's exoskeleton, composition of cuticle, and the efficiency of the immune system. Understanding mechanisms of insect resistance to *C. coronatus* infection is of great value when identifying effective methods of combating conidiobolomycosis in mammals. Our research shows that the composition of cuticular lipids is a key factor determining whether particular insect species becomes infected with *C. coronatus* or remains intact. We assume that the cuticular compounds that protect insects against *C. coronatus* infection may also protect mammals. Therefore, the research will be carried out using two *C. coronatus*-resistant insect species: *Lucilia sericata* (Diptera) and *Dermestes ater* (Coleoptera). The analysis of the cuticular lipids of these insects has already been performed by us and the results have been published.

In the project we are going to check the impact of substances identified in the cuticle of these insects on the physiological state of *C. coronatus* and its pathogenicity. The following parameters will be determined in fungal colonies cultivated in media supplemented with tested compounds: fungus growing rate, reached biomass, number of conidia and conidia virulence. In conidia, hyphae and post-incubation media (containing compounds released by growing fungus) activity of cuticle degrading enzymes (elastase, *N*-acetylglucosaminidase, lipase) and presence of mycotoxins will be detected. Following methods will be used: flow cytometry, spectrofluorometry, spectrophotometry, ELISA, GC-MS and LC-MS.

The planned research is innovative and will deepen knowledge in various scientific fields, including mycology, biochemistry, entomology, and insect pest control. The insect-fungus model is beneficial for studies evaluating the use of entomopathogenic fungi to control populations of insect pests and may also bring new ideas in the control of mycosis in humans, livestock and domestic animals. The obtained results will be of great importance for understanding the mechanisms regulating the pathogenicity of *C. coronatus* as well as ways protecting resistant insects against fungal assault. Obtained data can be used to design new methods of insect pest control and to develop new means of combating conidiobolomycosis in humans and animals.