

Physiological effects of a microsporidian infection: Alterations in carbohydrate and fatty acid levels in *Lymantria dispar* larvae

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Abstract

Vairimorpha sp. is a virulent microsporidian pathogen isolated from *Lymantria dispar* L. in Central Europe. The fat body is the target tissue of the infection; there, mass proliferation of *Vairimorpha* occurs and, finally, environmental spores are formed. The host is usually killed in the larval stage. Microsporidia are obligatory intracellular pathogens and thus completely depending on resources provided by the host. Little is known, however, on the physiological effects of a microsporidian infection on the host or the nutritional requirements of these pathogens themselves. In our study, we used an infection of the gypsy moth, *L. dispar*, with the microsporidium *Vairimorpha* sp. as a model to study the effects on the level of carbohydrates and fatty acids in the host.

Vairimorpha infection caused a total depletion of trehalose from host hemolymph during the course of infection. A steep, significant decrease of trehalose levels in the hemolymph of infected larvae occurred 5 days post infection (dpi). At that time mass proliferation of *Vairimorpha* began in the fat body, and first environmental spores were formed. Concentrations did not increase again during the subsequent sampling periods, while in uninfected larvae, hemolymph trehalose levels increased steadily during the fourth instar. Also a pronounced decline in the content of the storage carbohydrate glycogen was observed in infected hosts in the late phase of the infection. Consequently, the glycogen content was significantly lower than in controls 13 and 15 dpi. Moreover, *Vairimorpha* infection led to a reduction of fatty acids (palmitic, stearic, oleic, linoleic, and linolenic acid) in the hemolymph; levels were significantly lower 5, 7, and 9 dpi.

The results show that the microsporidian infection severely affects host metabolism. There are several possible explanations for our findings. This can be a consequence of nutrient uptake by the pathogen from the host cell. Also the infected host cell itself may use carbohydrates and fatty acids to support its increased energy metabolism; resulting ATP could be harnessed by the microsporidia. Finally, lower carbohydrate and fatty acid levels could result from a severely disturbed synthesis in infected fat body cells.