

## NOTE

# *Steinhausia mytilovum* in cultured mussels *Mytilus galloprovincialis* in the Thermaikos Gulf (northern Aegean Sea, Greece)

Abdalnasser Rayyan, Chariton C. Chintiroglou\*

Department of Zoology, School of Biology, PO Box 134, Aristotle University of Thessaloniki, 540 06 Thessaloniki, Greece

**ABSTRACT:** The microsporidian *Steinhausia mytilovum* was found parasitising female cultured mussels *Mytilus galloprovincialis* L. in the Thermaikos Gulf (northern Aegean Sea). The parasites affected the condition index of infected mussels and induced a strong hemocyte infiltration inside affected gonadal follicles. The prevalence (7.5 to 35.5%) of the parasite was relatively high in a polluted area.

**KEY WORDS:** *Steinhausia mytilovum* · *Mytilus galloprovincialis* · Mussel pathogens

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## INTRODUCTION

*Steinhausia mytilovum* (Field 1924) is a microsporidian parasite that infects the cytoplasm of mature mussel ovocytes. This parasite has a wide geographical range, including mussels from the Atlantic and Pacific coasts of the USA and the Italian coast (Lauckner 1983, Hillman 1991, Villalba et al. 1997). In Europe, this parasite was reported from cultured mussels of Galicia, Spain (Gonzalez et al. 1987, Figueras et al. 1991, Robledo et al. 1994), the Mediterranean coast of Spain (Bigas et al. 2000), and from the Gulf of Naples, Italy (Vincentiis & Renzoni 1963). In the Thermaikos Gulf (north Aegean Sea, Greece), the farming of mussels *Mytilus galloprovincialis* L. constitutes a very important industry (Arsenoudi et al. 2003). Because the farmers in this area claimed diminished harvest and reduction of mussel condition and because there is a lack of information about the health status of the mussels in Greece, a survey of mussel pathogens was initiated. The present paper focuses on *S. mytilovum* as a very important parasite of mussels. In addition to a description of the parasites, this paper reports on the prevalence, intensity and effects on the mussel host.

## MATERIALS AND METHODS

In May 2001, *Mytilus galloprovincialis* was collected from 'long-line' mussel cultures in 3 localities in the Thermaikos Gulf (north Aegean Sea). In total, 127 females were collected: 40 from Makrygialos, 45 from Halastra and 42 from Nea Michaniona (Fig. 1). The mussels were 5 to 9 cm in shell length. After collection, the mussels were cleaned of mud and biofouling organisms, measured, shucked and placed in 10% buffered formalin. Pieces of gonads were processed for histology following standard protocols. The condition index (CI) was calculated from total wet weight (TW), wet meat weight (MW) and shell weight (SW) based on the formula

$$CI = [MW/(TW - SW)] \times 100 \quad (\text{Aguirre 1979})$$

One-way ANOVA was used to compare the CI of infected and non-infected mussels.

## RESULTS

**Description.** Cysts of *Steinhausia mytilovum* were detected in the cytoplasm of ovocytes of some female mussels. Cysts were spherical, 11 to 15  $\mu\text{m}$  in diameter,

\*Corresponding author. Email: chintigl@bio.auth.gr

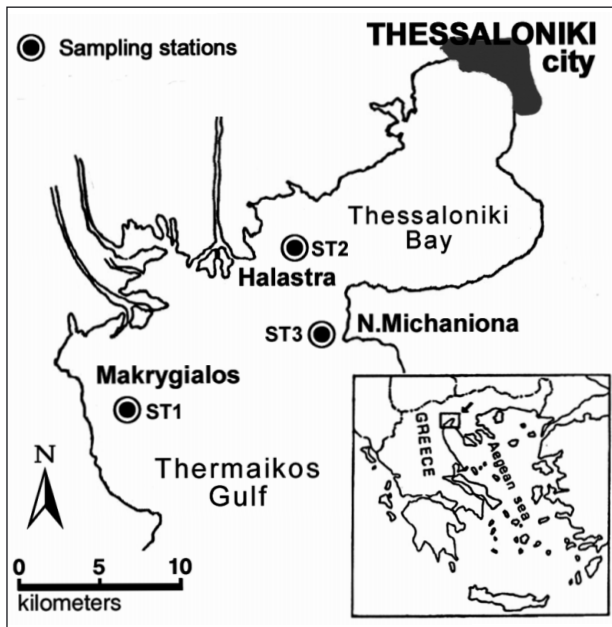


Fig. 1. Map showing the sampling stations in the Thermaikos Gulf (north Aegean Sea, Greece)

and contained numerous spores (1.4 to 2.6  $\mu\text{m}$  in diameter) with different degrees of maturity (Fig. 2). Up to 3 cysts per ovocyte were observed.

**Impact on the host.** This microsporidian parasite infected the cytoplasm of mature ovocytes. A heavy haemocytic infiltration was often observed inside affected gonadal follicles and in the connective tissue surrounding those follicles.

There was a significant difference in the CI of infected and non-infected females. The CI of infected females was significantly less than that of uninfected females (Fig. 3, 1-way ANOVA,  $F$ -ratio = 104,64,  $p$ -value = 0.0001).



Fig. 2. *Steinhausia mytilovum* microsporidian infection (arrow) in the cytoplasm of a *Mytilus galloprovincialis* ovum

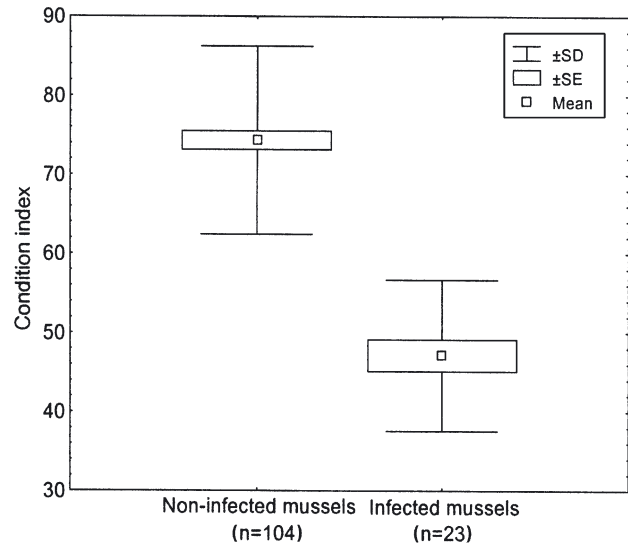


Fig. 3. *Mytilus edulis*. Condition index of mussels infected by *Steinhausia mytilovum*, and of non-infected mussels

#### Prevalence and intensity of *Steinhausia mytilovum*.

Among the 127 females examined from the 3 stations, 23 (18.1%) were infected with the microsporidium *S. mytilovum*. The prevalence of 35.5% among the female mussels from the polluted area (Halastra) was higher than the prevalence of the parasite at the other 2 stations (7.5% at Makrygialos and 9.5% at Nea Michaniona), which are far away from pollution sources. Moreover, the sections of infected mussels from Halastra had higher numbers of infected ova and more cysts inside the ova than the infected mussels from the other 2 stations.

#### DISCUSSION

Intracellular developmental stages of the microsporidian *Steinhausia* were ultrastructurally characterized, which allowed diagnosis of this genus (Sagrístá et al. 1998). The morphological features of the parasite and the location of the cysts were similar to that described by Lauckner (1983), Bower et al. (1994) and Villalba et al. (1997) for *S. mytilovum*. This is the first record and description of *S. mytilovum* from the Thermaikos Gulf, north Aegean Sea, eastern Mediterranean Sea. In this study, this parasite adversely affected the CI of infected mussels and incited a strong hemocyte infiltration response in agreement with Villalba et al. (1997) and Bigas et al. (2000). The effect on the viability of individual ova is unknown; however, mussel fecundity is believed to be inversely related to the intensity of infection (Bower et al. 1994). The prevalence of infection of the parasite *S. mytilovum* detected

in mussels in the present study was lower than reported in previous studies carried out in cultured *Mytilus galloprovincialis* from the Galician region of Spain (Figueras et al. 1991, Villalba et al. 1997) and from natural populations of *M. galloprovincialis* from the western Mediterranean, Spain (Bigas et al. 2000). The rate of parasite infection was high at the polluted site (Halastra), although Bigas et al. (2000) had recorded no relationship between metal concentration and the percentage of infested mussels.

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