



Frequent Oomycotic Infections in Eggs of Cultured Species

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Abstract

In aquaculture farms, incubation is a one crucial stage, as frequently shows high percentage of mortality. In fish and amphibians, egg oomycosis is a common infection during the early stages of embryonic development. Infection is usually promoted by unfertilized or damaged eggs that provide a medium for the zoospores to establish and grow, resulting in colonization and spread of the infection to nearby viable eggs. Numerous essential oils have been shown to have anti-oomycotic activity and to inhibit production and spore germination of Oomycetes species of the order Saprolegniales.

Keywords: Oomycotic Infections; Eggs; Incubation

Introduction

Aquaculture is growing worldwide and this impulse is leading to the intensification of production aquaculture systems to obtain large volumes of product. However, these systems generate environments that promote distress for cultured organisms. Handling procedures carried out during the incubation, rearing and fattening stages are important for the final product yield [1]. One of the crucial stages in culture farms is hatchery, as it usually shows a high percentage of mortality.

Infectious diseases, including oomycoses [2-4] are currently the most serious problem in the aquaculture industry [5-7].

During the prophylaxis, disinfection and control of oomycoses, several antibiotics are used, either in balanced food or in the form of baths. But the use of these drugs has led to the resistance of pathogens and the accumulation of residues in the tissues of aquatic organisms or in the environment [8-10]. This situation led producers and

researchers to look for alternative forms of therapy that were more economically profitable and compatible with the environment [11]. Actually, the effect of organic compounds of vegetable origin for the control of diseases caused by Oomycetes is being studied [3,12-14].

This review compiles the existing literature on the most frequent oomycotic infections in the eggs of cultured organisms and the natural antifungals used in aquaculture.

Oomycetes

Infections caused by Oomycetes have been described worldwide and affect aquatic organisms at all stages of their life cycle [15,16]. They are called water molds, since they are common components of aquatic biota that feed on the decomposition of organic matter [17]. These organisms produce mobile zoospores that have the ability to recognize a substrate or potential host, mobilize and adhere to it. The attraction and displacement of zoospores (chemotaxis) towards the eggs or the integument of aquatic organisms is an essential step in the infection process.

Within the oomycetes, have been recorded members of the genera *Saprolegnia* sp. (Nees), *Achlya* sp. (Ness), *Aphanomyces* sp. de Bary, *Calyptrolegnia* sp. Coker, *Dictyuchus* sp. Leitgeb, *Thraustotheca* sp. Humphrey, *Leptolegnia* sp. de Bary, *Pythiopsis* sp. de Bary, *Leptomitus* sp. C. Agardh and *Branchiomyces* sp. (Plehn) as causes of infections in natural, captive or experimentally induced conditions [18-21]. Only *Saprolegnia* sp., *Achlya* sp., *Aphanomyces* sp. and *Branchiomyces* sp. acquire relevance as pathogens in aquaculture.

Order Saprolegniales (Oomycetes)

Eggs saprolegniosis is a fairly common infection during the early stages of embryonic development in fish and amphibians [22-26]. It is mainly caused by species of the genera *Saprolegnia*, *Achlya* and *Aphanomyces* [27-29]. Several species that affect eggs with a high level of pathogenicity have been identified: *Saprolegnia diclina* (Humphrey), and *Achlya klebsiana* Pieters [30], *Saprolegnia parasitica* (Coker) [31], *Achlya americana* Humphrey [32,33] and *Achlya bisexualis* Coker, et al. [34]. The disease causes a high percentage of mortality in the farms of culture of freshwater and brackish water species [35]. Eggs are very susceptible during incubation due to water quality, handling, and high density [36]. Oomycotic invasion is promoted by unfertilized or damaged eggs acting as a medium for zoospores to settle and grow, resulting in colonization and spread of infection to nearby viable eggs [2,37]. The infection affects the chorion and, therefore, gas exchange, causing the death of the embryos [2]. Regular removal of infested eggs is necessary to control the infection [38].

Natural Anti-Oomycotics used in Aquaculture

A significant number of extracts and essential oils obtained from plants have antimicrobial activity against bacteria, algae and fungi [39-45]. Most of the compounds with antimicrobial activity found in dried plants and spices are phenolic compounds, terpenes, aliphatic alcohols, aldehydes, ketones, acids, or isoflavonoids [46]. Several of them were studied in order to identify active compounds associated with antioomycotic activity for their potential use as therapeutics in fish culture. In recent decades, several trials have shown that in aquaculture, plant extracts could be effective against species of the genera *Achlya* [3,47,48], *Saprolegnia* [5,12-14,26,31,47-56] and *Aphanomyces* [3,47,48,53]. In these works, the oomycocidal and oomycostatic activity of these substances against the mycelium or the inhibition in the production and germination of spores of Oomycetes species of the order Saprolegniales was evaluated, in many cases isolated from eggs or infected fish.

Geranium sp L, *Thymus vulgaris* L, *Eucalyptus*

camaldulensis Dehnh, *Allium sativum* L and *Artemisia sieberi* Besser essential oils were found to be oomycostatics against *S. parasitica* during the hatching and larval stages of *Oncorhynchus mykiss* Walbaum [51,57-59]. Mousavi, et al. [60] also obtained had positive effects on the survival rate of the rainbow trout eggs and larvae hatching with a combination of essential oils from *T. vulgaris*, *Salvia officinalis* L, *Eucalyptus globulus* Labill and *Mentha piperita* L.

Conclusion

In this review we have compiled the most common oomycotic diseases in aquatic organisms and the studies carried out in phytomedicine to evaluate the efficacy of natural products as oomycocidal and/or oomycostatic agents in eggs. The use of the phytotherapy presents promising potential in aquaculture as a substitute for chemotherapy.

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