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Antibacterial activity of marine macroalgae against fish pathogenic *Vibrio* species

Research Article

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Abstract: In mariculture, diseases of microbial origin can cause significant economic losses worldwide; the evolution of microorganism resistance to antibiotics has resulted in a growing need for new antibacterial compounds that are effective in veterinary medicine and characterized by limited undesirable side effects. Increased attention has recently been turned to seaweeds as a promising source for metabolites with antimicrobial activity. Vibriosis is a common disease, caused by bacteria of the genus *Vibrio*, that can result in high mortality in aquaculture. The aim of this study was to identify seaweeds with antibacterial activity against some pathogenic *Vibrio* species, in order to identify a possible alternative to the commonly used antibiotics in aquaculture. Chloroform/methanol lipidic extracts of six seaweed species (*Chaetomorpha linum, Cladophora rupestris*, *Gracilaria dura*, *Gracilaria gracilis*, *Gracilariopsis longissima*, *Ulva prolifera*) were tested for their antibacterial activities against six fish pathogenic *Vibrio* species using the disc diffusion method. Different susceptibilities to lipidic algal extracts were observed. All six of the seaweed extracts tested demonstrated inhibition of *Vibrio ordalii*. The best was that from *Gracilariopsis longissima*, showing activity against *Vibrio ordalii*, *Vibrio salmonicida*, *Vibrio alginolyticus* and *Vibrio vulnificus*. The results confirmed the potential use of seaweed extracts as a source of antibacterial compounds or as a health-promoting feed for aquaculture.

Keywords: *Antibacterial compounds • Mar Piccolo of Taranto • Mediterranean Sea • Seaweeds • Vibrio spp.*

1. Introduction

In aquaculture, diseases of microbial origin cause high mortality rates and lesions on fish skin, with consequent economic losses worldwide [1]. Bacteria, mainly of the genus *Vibrio*, such as *Listonella anguillarum* (formerly *Vibrio anguillarum*), *V. ordalii*, *V. harveyi, V. vulnificus, V. parahaemolyticus, V. alginolyticus, V. salmonicida*, have been identified as the etiological agents responsible for the most common disease outbreaks in fish and shellfish, called vibriosis [1-3]. Moreover, these microorganisms can accumulate in the reared animal's flesh and become a serious threat for human health. For example, *Vibrio vulnificus* is considered as one of the worst foodborne pathogen, mainly causing gastroenteritis. It is often present, together with *V. parahaemolyticus*, in the edible *Mytilus galloprovincialis* from the Italian Apulian farms [4,5].

The use of commercial antibiotics for disease treatment produces undesirable side effects, including toxicity to the reared organisms and the release of chemical residues into the environment. These chemical residues can then pose risk to the animal and human health [6]. In addition, it was reported that some *Vibrio* pathogenic strains, including *Vibrio harveyi*, *Vibrio parahaemolyticus* and *Vibrio splendidus*, are resistant to several antibiotics in common use [7]. This has led to a growing need for new antibacterial substances that can be effective in veterinary medicine and characterized by limited undesirable side effects [8].

Marine organisms are a rich source of structurally novel and biologically active metabolites [9,10]. Many of these marine compounds, which exhibit a range

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