



Antimicrobial Activity of *Saussurea costus* Against Bacterial Pathogens Isolated from the Gills of Common Carp (*Cyprinus carpio*) with Gill Disease

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ABSTRACT

Bacterial gill disease (BGD) is a major issue in aquaculture, often causing substantial mortality in farmed fish. This study evaluated the antibacterial efficacy of the Indian costus (*Saussurea costus*) root extract against bacterial isolates from the common carp (*Cyprinus carpio*) affected by BGD. Bacterial isolates, including *Aeromonas sobria*, *Sphingomonas paucimobilis* strain K3, and *Sphingomonas paucimobilis* strain E6-5, were tested against ethanolic *S. costus* root extract at varying concentrations (10%, 7.5%, 5%, and 2.5%) along with the antibiotic tetracycline. The results showed promising dose-dependent antibacterial activity, with *A. sobria* being particularly sensitive. The gas chromatography (GC) mass analysis of the ethanolic extract revealed a high diversity of bioactive compounds, especially lactones, phenols, and terpenes with known antibacterial properties. While tetracycline displayed greater potency, the findings suggest that *S. costus* extracts could potentially serve as a natural alternative for managing BGD and reducing the reliance on conventional antibiotics in aquaculture practices. However, before large-scale application, further research is needed to evaluate the efficacy, safety, and cost-effectiveness of utilizing *S. costus* extracts in the aquaculture field. Nonetheless, this study provides valuable preliminary data highlighting the antibacterial potential of *S. costus* against fish pathogens and the potential of exploring natural products from medicinal plants for sustainable disease management in aquaculture.

INTRODUCTION

The aquaculture sector produced 82.1 million tons of various aquatic animals in 2018, and the common carp (*Cyprinus carpio*) contributed to approximately 4.19 million tons of total production (FAO, 2020). *C. carpio* is the only freshwater fish raised in Iraq and is considered a source of income for the rural community in the country (Ahmed *et al.*, 2020; Ahmed, 2021). Aquaculture production has been plagued by many factors including diseases. High stocking density of fish in aquaculture enterprises increases the rate of disease outbreaks (Irshath *et al.*,