UNIVERSITY OF CALIFORNIA



SAN DIEGO

# ANTIMICROBIAL METABOLITES PRODUCED BY EPIBIOTIC BACTERIA: THEIR ROLE IN MICROBIAL COMPETITION AND HOST DEFENSE

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in Oceanography

by

Maria Sofia Gil-Turnes

Committee in Charge:

Professor William H. Fenical, Chairman
Professor Farooq Azam
Professor Wallis H. Clark, Jr.
Professor John. D. Faulkner
Professor Donald R. Helinski
Professor Nicholas D. Holland

1988

ABSTRACT OF THE DISSERTATION

Antimicrobial Metabolites produced by Epibiotic Bacteria: their Role in Microbial Competition and Host Defense

by

Maria Sofia Gil-Turnes
Doctor of Philosophy in Oceanography
University of California, San Diego, 1988
Professor William Fenical, Chairman

Although many bacteria have the ability to produce antimicrobial compounds in culture, it is not clear whether bacterial metabolites have an adaptive function in microbial competition. The work described in this thesis represents a new approach to microbial chemical ecology.

Three examples are described where antimicrobial compounds produced by epibiotic bacteria protect the host from encroachment by other microorganisms. Embryos of the caridean shrimp Palaemon macrodactylus are protected against infection by the pathogenic fungus Lagenidium callinectes by at least one strain of epibiotic bacteria. This strain produces 2,3-indolinedione, a strong antifungal agent. The American lobster, Homarus americanus, uses a similar strategy of defense against the fungus. Healthy embryos are

covered by a dense layer formed by a bacterial monoculture. These bacteria produce the compound p-hydroxyphenyl ethanol, which also inhibits fungal growth. Three strains of pigmented bacteria which occur in exclusive association with Microcoleus lyngbyaceus, a filamentous species of cyanobacteria, produce a potent antimicrobial compound. The compound, which had not been described previously, has considerable inhibitory activity against a number of fungi and bacteria.

The results of this research indicate that antimicrobial secondary metabolites indeed mediate microbial competition and strongly influence the establishment of associations between antimicrobial-producing bacteria and a variety of hosts.

Acknowledgements

I wish to express my thanks to many people at the Department of Marine Sciences of the University of Puerto Rico, particularly Dr. Luis R. Almodovar, who generously shared his knowledge, time and resources, and Mr. Godoberto Lopez, who taught me many important things.

Much of my work was done at the Bodega Marine Laboratories, where many students, staff members and faculty went out of their way to make my research possible. Their help and friendship was and is encouraging and inspiring.

I thank all the members of my committee, in particular Dr. Holland and Dr. Clark, who did much more than their share to see me through this venture.

I will always be thankful to Dr. James Haley for that first Symbiology course.

Financial assistance came from a variety of sources: * Seagrant, San Diego Oportunity Fellowships and the ARCS Foundation, the Institute of Marine Resources and the Society of Sigma Delta Epsilon. The Department of Biology at UCSD allowed me to be a teaching assistant and the UCSD Financial Assistance Office always came through with loans and grants during several difficult times.

* California Sea Grant College Program

NA80AA-D-00120
Fenical; R/MP-22