NATURAL PRODUCTS CHEMISTRY AND CHEMICAL ECOLOGY OF TROPICAL MARINE ALGAE

A thesis submitted by
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Abstract

This thesis reports results from an investigation of the natural product chemistry and chemical ecology of tropical marine algae. The research has led to the discovery of novel metabolites in a number of algal species and demonstrated the ecological role of selected isolated metabolites.

Chapter one provides a general overview of the roles of secondary metabolites in the marine algae, including a review of all algal secondary metabolites previously investigated for their role in ecological interactions.

The algal Division Rhodophyta proved to be a rich source of secondary metabolites. Chapter two describes the structural elucidation of novel metabolites from the algae *Laurencia mariannensis, L. majuscula, Dasyphila plumerioides* and *Delisea pulchra* using chemical manipulations and high field nuclear magnetic resonance spectroscopy. The presence of previously reported metabolites, a number of which have now been fully characterised or reassigned, is also described.

The algal Divisions Chlorophyta, Phaeophyta and Cyanophyta proved to be less chemically rich than the Rhodophyta yielding only previously reported metabolites. Chapters three to five describe chemical investigations of the Chlorophyta *Microdictyon obscurum* and *Chlorodesmis fastigata*, the Phaeophyta *Sargassum* spp., and the Cyanophyta *Lyngbya* sp.

An opportunistic investigation of the natural product chemistry of the blue coral *Heliopora coerulea* (Alcyonacea) yielded interesting secondary metabolites of potential ecological significance. Chapter six describes the elucidation of novel metabolites from *H. coerulea.*

The ecological role of selected algal metabolites is described in the latter part of the thesis. Chapter seven treats the chemically mediated interaction between the red alga *Plocamium hamatum* and the alcyonacean soft coral *Sinularia cruciata.* Experimental studies have shown that the algal secondary metabolite chloromertensene plays a major role in allelopathic interactions with *S. cruciata.* The importance of natural irradiance levels on the distribution of the alga and its possible influence on the selection of secondary metabolites with allelopathic function is also discussed.

Chapter eight identifies the chemical defences of the temperate red alga *Delisea pulchra* against common herbivores. *In situ* feeding experiments were carried out to determine the deterrent effect of purified metabolites isolated from the alga on selected herbivore species.

Foreword

This thesis is presented in nine chapters. Chapter 1 is a general introduction to the natural products chemistry and chemical ecology of marine algae. The following chapters are divided into two major sections, the first on the isolation and structural elucidation of secondary metabolites from tropical marine algae (Chapters 2, 3, 4, 5) and a soft coral species (Chapter 6); and the second on chemical ecology studies of secondary metabolites isolated from tropical and temperate algae (Chapters 7 and 8). The final chapter (Chapter 9) contains the experimental data associated with the natural products chemistry section of this thesis.

Due to the combining of both chemical and ecological studies in this thesis, a composite literature referencing system has been adopted. This is designed to allow chemically and ecologically directed readers easier access to information referenced in this thesis. All information is referenced in the text in biological format (e.g. Bakus *et al.* 1986), and in the reference section in alphabetical order. However, for convenience all references of a chemical nature are presented in the format adopted by the journal, *Australian Journal of Chemistry*, while all those of a biological nature are presented in the format adopted by the journal, *Marine Biology*.

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