

# CHAPTER 1

## Introduction

Actinobacteria are Gram-positive, fungi-like bacteria, which form mycelia [Prescott *et al.*, 1993]. These organisms are considered attractive sources of natural compounds with applications in numerous industries, such as the agricultural, pharmaceutical along with various other industries. These compounds and their secondary metabolites have been proven and revealed to have significant potential in the generation and development of herbicides, pesticides and antibiotics for future use. Up to 80% of disinfectants that have been isolated from actinomycete metabolites are from the genera *Streptomyces* and *Micromonospora* [Pandey *et al.*, 2004]. Between the years of 1988 and 1992, a thousand new secondary metabolites from actinomycetes were discovered. In recent years, these organisms have been studied and isolated from various habitats. Therefore, the likelihood for the discovery of novel secondary metabolites has increased [Shomura, 1993].

Actinomycetes have been identified as a widely distributed group of microorganisms in nature, which are mostly found in the soil as free-living saprophytes. However, some actinomycetes live in plants as endophytes [Cao *et al.*, 2005; Hasegawa *et al.*, 2006]. Most actinomycetes that have been isolated from the soil belong to the genus *Streptomyces* [Watve *et al.*, 2001; Mellouli *et al.*, 2003]. The important habitat for actinomycetes consists plant rhizosphere soils [Suzuki *et al.*, 2000]. These organisms have received a considerable amount of attention with regard to their capabilities in root protection by producing enzymes, which degrade the potential fungal pathogen cell walls and for their production of antifungal compounds [Ilic *et al.*, 2007; Prapagdee *et al.*, 2008]. Additionally, they can produce plant growth promoters such as indole acetic acid (IAA) to assist the growth of the roots or to produce siderophores to improve nutrient uptake [Merckx *et al.*, 1987; El-Tarabilya and Sivasithamparamb, 2006]. Moreover, actinomycetes have been identified as organisms that are have an important

association with many other organisms, e.g. ants [Currie *et al.*, 1999], honey bees [Gilliam, 1997], marine mollusks [Romanenko *et al.*, 2008], marine sponges [Jiang *et al.*, 2008], lichens [González *et al.*, 2005], submersed freshwater macrophytes [Wohl and McArthur, 1998], and marine macroalgae [Wiese *et al.*, 2009].

Macroalgae is potentially one of the most interesting sources of actinobacteria. Some publications have reported on microbes that were isolated from the seaweed. These microbes showed potent antibacterial activities. To date, there has been no report of this type of microorganism being acquired from freshwater macroalgae. In northern and northeastern Thailand, there are abundant growths of freshwater macroalgae that occur in the cool-dry season. These algae may be an untapped source of actinobacteria for novel bioactive compounds. It is the aim of this study to explore the actinomycete diversity associated with some freshwater macroalgae.

In this research study, we used culture dependent and culture independent methods to examine the diversity of the actinomycetes. All isolated actinomycetes determined to be culture dependent will be screened for their antimicrobial properties.

### **1.1 Objectives**

The objectives of this study are as follows:

- 1.1.1 To examine the diversity of actinomycetes associated with some edible freshwater macroalgae using culture-dependent and culture-independent approaches.
- 1.1.2 To screen the obtained antimicrobial isolates for any potentially beneficial properties