

VIỆN KHOA HỌC VÀ CÔNG NGHỆ VIỆT NAM

VIETNAM ACADEMY OF SCIENCE AND TECHNOLOGY

ISSN 1811-4989

TẠP CHÍ

CÔNG NGHỆ SINH HỌC

JOURNAL OF BIOTECHNOLOGY

Tập (Volume) 10 Số (Number) 1 2012

## ANTIMICROBIAL CHARACTERISTICS AND TAXONOMICAL DIVERSITY AMONG ACTINOMYCETES ISOLATED FROM CATBA ISLAND, VIETNAM

Le Phuong Chung<sup>1</sup>, Nguyen Quynh Uyen<sup>2</sup>, Nguyen Huynh Minh Quyen<sup>2</sup>, Nguyen Thi Van<sup>2</sup>, Dinh Thuy Hang<sup>2</sup>

<sup>1</sup>Nhatrang University

<sup>2</sup>Institute of Microbiology and Biotechnology, Vietnam National University Hanoi

### ABSTRACT

In this study, 424 actinomycete strains isolated from soil and litter samples on Catba island (Haiphong, Vietnam) were subjected to the screening for the inhibitory activities against microorganisms, including bacteria (*Micrococcus luteus*, and *Escherichia coli*) and eukaria (*Candida albicans* and *Fusarium oxysporium*). Through two screening steps, 17 strains were selected for their high inhibitory activity against one or more target microorganisms. Crude extracts in ethyl acetate from culturing media of the selected strains were analyzed via thin-layer chromatography (TLC) and high performance liquid chromatography (HPLC), in which chloramphenicol, kidasamycin, erythromycin and raw extract of anthracycline were used as standards. The obtained results showed that antibiotic substances produced by the selected strains could not be put in any group of the analyzed standards, except the strain A396 which appeared to produce a chloramphenicol-like antibiotic. Taxonomical studies based on the morphology and 16S rDNA sequencing indicated that the collection of actinomycetes isolated from Catba island contained mainly *Streptomyces* species (about 70%) and the group of rare actinomycetes (non-*Streptomyces*) which made of 30% of the collection was dominated by *Micromonospora*, *Nonomureae* and *Nocardia* genera. Of the 17 selected strains with highest antimicrobial activity, ten strains were affiliated to the genus *Streptomyces* (as based on the morphology) and seven strains belonged to the genus *Nonomureae* (as based on 16S rDNA sequence analyses). The strains selected in this study could serve as sources for discovering new antibiotic substances in Vietnam.

**Keywords:** antibiotics, actinomycetes, *Streptomyces*, *Nonomureae*, TLC, HPLC

### INTRODUCTION

In the context of alarming increase of antibiotic resistance among pathogens, search for new antimicrobial agents with different mechanisms of action is becoming utmost important (Habte-Gabr, 2002; Tenover, 2006). The history of new drug discovery shows that novel skeletons, in the majority of cases, come from natural sources such as microbial and plant extracts. Among microorganisms, actinomycetes present one of the most attractive sources of antibiotics and other biologically active substances of highly commercial value. Currently about 16,500 antibiotics have been discovered from microorganisms, two-thirds of which was produced by actinomycetes (Hopwood, 2007). Various antibiotic substances from actinomycetes have been characterized, including aminoglycosides, glycopeptides,  $\beta$ -lactams, macrolides, nucleosides, peptides, polyenes, polyester, polyketides, (Goodfellow *et al.*, 1988). These substances have been successfully used as herbicides, anticancer agents, drugs,

immunoregulators and antiparasitic agents (Thomson, Bialphos, 1995).

Actinomycetes are Gram positive bacteria having high G+C content (>55%) in their DNA. The majority of actinomycetes has free living, saprophytic life form and is widely distributed in soil, water and plant litter. Actinomycetes play an ecologically important role in material recycling in nature, they decompose and utilize difficult-to-degrade organic matters such as humic acid in the soil. At the presence, actinomycetes are defined as the order *Actinomycetales* which is consisted of 13 suborders, 42 families and about 200 genera (Ashutosh, 2008; Duong, Ando, 2010).

This study aimed to investigating biodiversity and to screening actinomycete strains exhibiting high antimicrobial activity among a collection of actinomycetes isolated from Catba island, a national park with rich biodiversity in Vietnam. The selected strains were then subjected to further studies on the antibiotic substances produced as well as their phylogenetic affiliation.