

1.1 Introduction

The study of microbial biodiversity has gradually expanded from the temperate and tropical regions to the extreme environmental region such as Antarctica. Despite the extreme conditions in Antarctica, many different types of plants, animals and microorganisms are able to survive as well as reproduce (Boyd and Boyd, 1963). Microorganisms from Antarctic region showed promising sources of antimicrobial compounds (Nichols *et al.*, 2002; O'Brien *et al.*, 2004; Giudice *et al.*, 2007) and serves an important route towards the discovery of new bioactive compounds.

Signy Island (60° 43' S, 45° 38' W) is one of the South Orkney Islands located in the South Atlantic Ocean on the Southern arm of the Scotia Ridge, is in the maritime Antarctica with mean annual air temperatures around -3.5 °C (Gugleilmin *et al.*, 2008). It has penguin rookeries, seal wallows and areas predominated with Antarctic grass or with lichens and mosses. About 50% of the surface of Signy Island is free from ice and snow during summer and with its varied terrain the lowland and coastal zone provides a diversity of habitats (Holdgate, 1967).

Many bacterial diversity studies were conducted on aquatic environments in Antarctica, which included ice sheet (Lanoil *et al.*, 2009), lake water (Pearce, 2003; Pearce *et al.*, 2003, 2005) and meltwater lake sediments (Sjðling and Cowan, 2003). In addition, bacterial diversity studies were also conducted in Antarctica soil samples (Aislabie *et al.*, 2006; Smith *et al.*, 2006; Neiderberger *et al.*, 2008). Actinobacteria have been identified as one of the dominant communities in the Antarctic soils (Aislabie *et al.*, 2006; Babalola *et al.*, 2009).

Isolation of actinobacteria from soil environments have also been reported (Strzelczyk *et al.*, 1969; Moncheva *et al.*, 2002; Nichols *et al.*, 2002; Nediaalkova and Naidenova, 2005). Various novel actinobacteria such as *Friedmanniella antarctica* (Schumman *et al.*, 1997), *Micrococcus antarcticus* (Liu *et al.*, 2000), *Modestobacter multiseptatus* (Mevs *et al.*, 2000), *Leifsonia rubra* (Reddy *et al.*, 2003a), *Kocuria polaris* (Reddy *et al.*, 2003b), *Arthrobacter gangotriensis*, *Arthrobacter kerguelensis* (Gupta *et al.*, 2004) and *Sanguibacter antarcticus* (Hong *et al.*, 2008) were isolated in various places in Antarctica thus prove Antarctica as a valuable region of research. The search of novel Actinobacteria now centres on the bioprospecting of extreme environments such as Antarctica (Nichols *et al.*, 2002).

Actinobacteria showed capability in the development of new substances for pharmaceutical, medicinal or the agricultural field (Gushterova *et al.*, 2005; Nediaalkova and Naidenova, 2005; Moncheva *et al.*, 2002). They are also well known as producers of biologically active and pharmaceutically important secondary metabolites which include antibacterial, antifungal, anticancer, antiviral antibiotics (Esther *et al.*, 2004; Oskay *et al.*, 2004; Midayoh *et al.*, 1997). Many of these secondary metabolites are synthesized by non-ribosomal peptide synthetases (NRPS) pathways (Bredholdt *et al.*, 2007). Moncheva *et al* (2002) and Nediaalkova and Naidenova (2005) screened for antimicrobial activities isolated from Antarctic soils while Brutner *et al.* (2005), discovered a new antibiotic Frigocyclinone, produced by *Streptomyces griseus* strain NTK97 isolated from Antarctica. Isolates of actinobacteria collected from seawater samples from Antarctica also showed antibacterial activities and this suggests that Antarctic could be a new source of antibiotics of pharmaceutical interest (Giudice *et al.*, 2007).

Stackebrandt and Schumann (2006) stated that although many new genera and strains of actinobacteria have been discovered and classified in the last decade, the

medical, ecological and/or biotechnological importance of these new taxa have not yet been evaluated thoroughly. Hence, a study was carried out to isolate actinobacteria from Antarctic soil samples, characterise these isolates and screen them for antibacterial activity. Soil samples were collected from Signy Island during austral summer of 2005/2006.

1.2 Objectives

- ❖ To isolate, identify and enumerate actinobacterial strains from Antarctic soil samples.
- ❖ To characterize isolated actinobacterial strains using morphological, chemotaxonomic and molecular methods.
- ❖ To screen the actinobacterial strains for antibacterial activities and presence of Nonribosomal peptide synthetases (NRPS) genes.