CHAPTER 1

General Introduction and Thesis Outline

1.1 Historical background

Skin infectious diseases are major health problems worldwide. Many microorganisms such as *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Micrococcus* spp. and *Propionibacterium acnes* are often reported as causative agents of skin illness. In recent year, resistance by pathogenic bacteria has been increasing and become a major health concern especially many Gram-positive bacteria that were resistant to virtually every clinically available drugs. This increasing problem of multi-resistant pathogenic strains, which can cause substantial morbidity and mortality, especially among immunocompromised patients, has led to an increasing search for new antibacterial agents (Rosamond and Allsop, 2000). The best dramatic example of resistance in bacteria is *S. aureus*, which belong to Micrococcaceae family. Staphylococcal infection is a major cause of various skin and soft tissue diseases and possibly progress to severe diseases. However, many strains of *S. aureus* are developing resistance to available antibacterial agents, creating a serious problem in medical microbiology. The disruption of the growth cycle by preventing the synthesis and assembly of the key components of bacterial processes such as cell wall synthesis, DNA replication, protein synthesis and virulence factor inhibition are the main strategies for searching new antimicrobial agents (Rasko and Sperandio, 2010).

Free radicals are atoms or groups of atoms with unpaired electrons and can be formed when oxygen interacts with certain molecules. Several oxidants such as reactive oxygen species and reactive nitrogen species are implicated in contributing of pathophysiology of a variety of pathological conditions including cancer, aging, atherosclerosis, inflammation, heart disease, carcinogenesis and neurodegenerative disorders such as Alzheimer's disease and Parkinson's disease (Emerit *et al*., 2004; Junqueira *et al.,* 2004; Franco *et al.* 2008).

Natural products from various sources such as plants, animals and microorganisms have been used for thousand of year in folklore medicine to treat health disorders and to prevent diseases. The knowledge of their treatment properties has been transmitted over the centuries within and among human communities. Currently, research interest has been focused on the antioxidant activity on natural sources. Medicinal plants contain a wide variety of free radical scavenging molecules such as carotenoids, phenolic compounds, benzoic acid derivatives, flavonoids, proanthocyanidins, stilbenes, coumarins, lignans, lignins and some other endogenous metabolites that are rich in antioxidant activity (Gupta and Sharma, 2006; Maestri *et al.*, 2006; Ndhlala *et al.*, 2010). There were numerous studies that conducted on biological activities of medicinal plants such as antioxidant, anti-inflammation, anticancer, and antimicrobial activities. Therefore, plants are an alternative choice in recent year for treatment diseases and used for health supplement products. The purposes of this research were to study the antibacterial and antioxidant activities of medicinal plant extracts. The objectives of this study were as follows.

1.2 Objectives

1. To investigate anti-bacterial activities of some medicinal plant extracts.
2. To investigate anti-free radical activities of some medicinal plant extracts.
3. To search for some active compounds from medicinal plant extracts that confers anti-bacterial and anti-oxidant activities.

1.3 Scope

This thesis described a program of research on strategies to investigate antibacterial and antioxidant activity in some Thai medicinal plant extracts and study the inhibition of bacterial gene expression by selected plants. Setting the background to this work, Chapter 2 reviewed the knowledge of skin infections, general knowledge of mode of action of antimicrobial agents, virulence factor and antibiotic resistance in *S. aureus*, free radical and antioxidant compounds and some previous researches, which were relevant to our study and review about medicinal plants which used in this study.

Chapter 3 described the screening of antibacterial activity in 22 medicinal plant extracts. The fractionation and screening for phytochemical constituents in selected medicinal plants, which had the highest activity were performed. Bacterial cell morphology alterations by some plant extracts on bacterial cell using scanning electron microscope (SEM) were investigated. The mode of action of selected plants was also conducted on bacterial mRNA and protein gene expression. Characterization of MRSA clinical isolates by molecular technique was also performed and *mecA* gene mutations in MRSA were investigated by DNA sequencing technique.

Chapter 4 described the screening of antioxidant activity and total phenolic content of 22 Thai medicinal plant extracts. The ability of plant extract on oxidative protein damage inhibition was also conducted. The fractionation and screening for their phytochemical constituents in selected plant extracts which had high antioxidant activity, was also performed.

Chapter 5 was a summary of the data described in this thesis.