CHAPTER 1

INTRODUCTION

Curcuma alismatifolia Gagnep., also known as the Siam tulip or Pathumma, is native plant of South-East Asia. An attractive flower is recollective to a group of tulips (Bunya-atichart *et al.*, 2004). Pathumma is a member of the family *Zingiberaceae*, which is found in north and northeastern regions of Thailand ranging from sea level up to 790 m above mean sea level. These ornamental plants become more popular not only in Thailand but also in foreign countries. The annual exported value of rhizomes is about 20-30 million baths (Pathumma, 2011). The important markets have been the United States of America, Japan, the Netherlands, German and Australia (Thongwai and Kunopakarn, 2007). The increase in demand of this plant leads to rapid genetic erosion caused by over-harvesting and land clearing (Paisooksantivatana *et al.*, 2001). During cultivation, Pathumma is susceptible to many diseases including bacterial wilt which is one of the most important constraints. The prominent wilt-causing bacterium is *Ralstonia solanacearum* (Wydra and Beri, 2006), which devastates several economic plants particularly tomato, ginger and banana resulting in crucial losses to growers. However, several reports showed that *Enterobacter* spp. could cause bacterial wilt in worldwide crops. Some strains of *E. cloacae* have been associated with rot of ginger rhizomes (Nishijima *et al.*, 2004). *E. sakazakii* induced internal yellowing of papaya fruit (Keith *et al.*, 2008). *E. asburiae* and *Enterobacter* spp. caused mulberry (*Morus alba*) wilt disease. *Enterobacter* sp. is Gram negative, rod-shaped and facultative anaerobic bacteria. It was previously

grouped in genus *Erwinia* and has transferred to genus *Enterobacter* based on molecular and taxonomic studies (Wang *et al.*, 2010).

The soil-borne pathogens are difficult to control because they attack plants from soil for extended periods (Boukaew *et al.*, 2010). To manage wilt disease using crop rotations is practically impossible due to the persistence or survival of pathogens in soil for long period of time (Abdullah *et al.*, 2008). The extensive prevention and sanitation measures that are imposed to eradicate wilt disease from the chain are costly and have serious economic consequences for the entire Pathumma sector (Breukers *et al.*, 2006). The chemical control has its own limitations, public attitude and environmental concerns. The agrochemical treatment causes environmental pollution, residue persistence, decreased diversity of non-target organisms, development of pathogenic resistance and shifting of cultivating area (Khamna *et al.*, 2009; Thongwai and Kunopakarn, 2007).

The future sustainable agriculture will increasingly rely on the integration of biotechnology with traditional agriculture. Most sustainable and environmentally acceptable control may be achieved using biocontrol agents due to the effort to reduce the use of agrochemicals and their residues in the environment and in food (Haggage and Mohamed, 2007). Plant pathologists have been fascinated by the idea that such microorganisms could be used as environmentally friendly biocontrol agents that are no effect to non-target organisms (Haas and Défago, 2005). The antagonistic microorganisms emerged as an alternative management strategy. Among several biological control agents, *Bacillus* and *Pseudomonas* are one of the potential agents against plant diseases since they can produce various metabolites such as antibiotics and siderophores (Boukaew *et al.*, 2010).

Complete eradication of wilt disease from the Pathumma production chain has still not been achieved. Despite extensive research on their pathogenesis, epidemiology and control, wilt-causing bacteria infection remains among the most important plant pathological problems worldwide (Kiss *et al.*, 2003). Biological control of wilt disease is particularly challenging due to the long duration of host susceptibility to the pathogen and the occurrence of the disease patches in the fields. More efforts are needed to prove the efficacy of these methods in horticultural practices (Pierson and Weller, 1994).

Thesis objectives

1. To identify and investigate pathogenicity and survival of wilt causing bacteria isolated from infected Pathumma
2. To screen for antagonistic bacteria capable of inhibiting growth of wilt causing bacteria in Pathumma
3. To evaluate beneficial effect of antagonistic bacteria on Pathumma beds