CHAPTER 1

Introduction

Curcuma is a perennial rhizomatous ornamental plant and a member of the ginger family Zingiberaceae (Phongpreecha, 1997). This genus comprises of 80 species, common name of the herbaceous plants collectively known in Thai as ‘Pathumma’, ‘Krachiao’ or ‘Bua Sawan’ (Sirirugsa *et al.*, 2007). It is distributed over the tropics from India, Burma, Indochina, Thailand and Malaysia. In Thailand, about 30 species were found (Chittendan and Synge, 1981). *C. alismatifolia* Gagnep. is one of the species that has colorful bracts and long-lasting flowers which is suitable for both cut flower and pot plant. Thailand exports about four million rhizomes per year to Germany, Japan, Portugal, etc., and export volume increases annually (Department of Agricultural Extension, 2005). Generally, rhizome is grown in April and growers supply a high level of nitrogen fertilizer (15 g per plant of N-P-K [15-0-0] or N-P-K [21-7-14] compound fertilizer) once a month from the two-leaf fully-expanded stage until the flowering stage, and then change the fertilizer ratio to N-P-K [13-13-21] at the same rate (Ruamrungsri *et al.*, 2006). Since the price of chemical fertilizer increases year by year, this brings about the decrease of benefit and income. The alternative method to reduce chemical fertilizer use is thus needed for *Curcuma* production. The endophytic diazotrophic bacteria (EDB) and arbuscular mycorrhizal fungi (AMF) have high potential for application in agriculture and could lead to a considerable decrease in the amount of chemical fertilizers.

AMF have been reported to occur in many agriculturally- and economically-important crops such as sunflower (Riaz *et al*, 2007), cowpea (Ngakou *et al*., 2007), soybean (Ganty *et al*., 1985) and maize (Gutiérrez-Miceli *et al*., 2008). About 80% of AMF plants are found to increase phosphate (P) uptake and growth. Besides, AMF have beneficial effects on soil aggregation, soil fertility and other harmful organisms (Mridha, 2003).

Many reports showed plant growth promoting by EDB, such as it had ability for nitrogen fixation in association with rice (12-74 µmolC_2H_4/plant/24hr) and wheat (0.6-3.1 µmolC_2H_4/plant/24hr) (Anwar, 1999) and *Dendrobium crystallinum* (0.02-6.23 µmol C_2H_4/plant/24hr) (Chuanchaisit, 2006). Regarding auxin production by endophytic bacteria, there have been many reports of its presence involving various plant species, such as *Calanthe vestita* (1.18-6.60 µg IAA/ml) and *Azolla filiculoides* (1.5-10.1 µg IAA/ml) (Forni *et al*., 1992; Tsavkelova *et al*., 2005). They were also useful for increasing biomass, N-uptake and fertilizer-N use efficiency (Anwar, 1999). These researches indicate that AMF and EDB have potential in many crops. They can reduce the need for fertilizer N and P, increase income from high yields, reduce fertilizer costs and reduce ground water (Andrews *et al*., 2003; Kennedy *et al*., 2004).

Therefore, this research was aimed to determine the advantage of EDB and AMF in *C. alismatifolia* Gagnep. production which included three experiments.

Experiment 1: to examine EDB potential as growth promoters for *Curcuma* plantlets and identification. Experiment 2: to study morphology, growth promotion and identification of AMF in *Curcuma* plantlets. Experiment 3: to determine the effect of AMF and EDB combined with fertilizer application on growth and development of *C. alismatifolia* Gagnep.

Objectives

1. To select and identify the efficient EDB and AMF for growth promotion of *C. alismatifolia* Gagnep.

2. To evaluate the potential of EDB and AMF on growth and nutrient uptake of *C. alismatifolia* Gagnep.