CHAPTER 1

INTRODUCTION

1.1 Principles, rationale and hypothesis

Tangerine fruit (*Citrus reticulata* Blanco) cv. 'Sai Num Pung' is a non-climacteric subtropical fruit, and the main economically important citrus crop in the north of Thailand. In 2005, the total Thailand tangerine productions were about 670,000 ton. Tangerines differ from oranges because nearly all tangerine production is intended for the fresh market. Most tangerines are consumed in the country of production. Its consumptive demand is attributed to its high vitamin C content and its antioxidant potential (FAO, 2008a). Owing to the fact that tangerines are smaller than other citrus fruits and the peel structure is thinner, so they can be easily damaged (South Australian Research and Development Institute, 2008). Damage in terms of injuries which occurs during harvest and subsequent handing allows the entry of wound pathogen, including *Penicillium digitatum* Sacc., resulting to green mold rot. Spores of this fungus are ubiquitous in citrus-growing areas and in the fruit-handling environment, and causes serious postharvest losses annually (Palou *et al*., 2001; Obagwu and Korsten, 2003).

Besides, tangerine fruit have a short growing season and do not maintain good quality when kept at ambient temperature. Cold storage is essential for extending the consumption period of fruits, regulating their supply to the market and also for long distance transportation. Tangerines can be stored for 2-5 weeks in good condition at low-temperature. However, chilling injury is a problem associated with low-temperature storage of tangerines, which can develop during or after low-temperature storage (Arras, 2001; Ladaniya, 2002). Chilling injury is manifested as peel pitting which turns from brown to black blemishes with increasing damage and decay development. They are causes considerable commercial losses and can become a limiting factor in the extension of their storage and marketing periods (Porat, 2004).

In developing countries, where protection and proper handling of fresh fruit is inadequate, losses during transit and storage can represent in excess of 50% of the harvested crop (Kader, 2002). Commercial decay control measures commonly include careful handling to minimize fruit injury. Currently, Penicillium rot in the north of Thailand is controlled by application of imazalil and thiabendazole. However, alternative methods are needed because the widespread use of these agrochemicals in commercial packinghouses has led to proliferation of resistant strains of the pathogens. Furthermore, concerns about human health risks and protection of the environment, associated with fungicide residues have increased the need for the development of safe and effective alternatives (Palou *et al*., 2002; 2007).

Heat treatment technology is a safe and environmentally-friendly procedure with increasing acceptability in commercial operations. It has been used successfully to control the incidence of postharvest disease in several commodities (Fallik, 2004). Pre-storage hot-water-dips of fruit at temperatures above 40°C are effective in controlling storage decay, not only by reducing the pathogen inoculum but also by enhancing the resistance of the fruit tissue and influencing host metabolism (Schirra *et al*., 2000). Additionally, these treatments enhance fruit resistance to chilling injury in sensitive cultivars (Rodov *et al*., 1995; Schirra and D'hallewin, 1997; Lurie, 2005). Based on the evidence, there is no study on the effect of heat treatment on anatomical and biochemical changes in the peel of tangerine fruit cv. 'Sai Num Pung' during *P. digitatum* infection and chilling injury under low-temperature storage. In the near future, a better understanding of the anatomy and biochemistry of hot-water treated tangerine fruit will bring about high precision and effectiveness of hot-water treatment techniques. However, these simple technologies should be focused on two main themes which are broader range of fresh harvested commodities and quarantine purposes. Relevant research will lead to successfully reduce our current extensive reliance on fungicides and help to protect the present environmental circumstances. In this study, it is suggested that enhancement of fruit tolerance to low-temperature by reducing chilling injury or by enhancing fruit resistance to decay-causing agents could allow prolonged storage at low-temperature. This study will also focus on the efficacy of the hot-water treatment to control green mold and chilling injury in order to develop the technique for Thai citrus packinghouse operations use.

1.2 Research objectives

1.2.1 To investigate the effect of heat treatment on anatomical characteristics and biochemical changes following infection of *P. digitatum* compared with healthy tangerine fruit under low-temperature storage.

1.2.2 To study the effect of heat treatment on biochemical changes of the peel in normal tangerine fruit compared with those stored under chilling temperature.

1.3 Research scope

1.3.1 Uses of scanning electron microscope (SEM) to study the effect of heat treatment on anatomical characteristics on artificially-inoculated tangerine fruit.

1.3.2 Study on the effect of heat treatment on artificially-inoculated tangerine fruit and chilling injured in tangerine fruit peel by biochemical changes analysis.

1.4 Usefulness of the research

Results from this research will help to clarify the interaction between heat-treated tangerine fruit and *P. digitatum*. as well as, the relationship between heat-treated tangerine fruit peel and chilling injury during storage at low-temperature. Furthermore, this research should be helpful in developing methods to control green mold and chilling injury and therefore should be an important alternative to extend storage life and maintain the quality of tangerine fruit.

1.5 Research locations

1.5.1 Postharvest Technology Research Institute, Chiang Mai University, Chiang Mai 50200, Thailand

1.5.2 Postharvest Laboratory of Horticulture, Department of Plant Science and Natural Resource, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand