CHAPTER I

INTRODUCTION

1.1 Introduction

Plants are the largest natural source of producing bioactive compounds called plant secondary metabolites and are intensively harvested from plants to improve human health and living standards as pharmaceuticals, agrochemicals, flavours, fragrances, pigments, bio-pesticides and food additives (Leicach and Chludil, 2014). Plants are widely used globally as a source of raw materials in the pharmaceutical industry. The World Health Organization (WHO) states that about 80% of humans worldwide use medicinal plant materials for health therapy (Raskin *et al*., 2002).

However, the high level of human activity affects the preservation of nature and causes a lot of damage to nature, such as various environmental factors, for example air pollution generated by vehicles, reduction of productive land due to development, and exploitation activities of substantial natural resources, contamination from pesticide pollution, herbicides, fungicides, and heavy metals from industrial waste have become obstacles in crop cultivation (Kosalec *et al*., 2009). In other words, the drug activity and efficacy of bioactive compounds derived from medicinal plants can be weakened by environmental disturbances and physiological damage. The production of secondary metabolites is highly dependent on the developmental process and physiological state of the plant, and the yield is often very low (less than 1% of the total carbon). Thus, the

natural production of medicinal plants cannot meet the ever-increasing market demands.

In order to overcome some of the reasons described above, advances in biotechnological methods in in vitro culture have been studied intensively over the last few years as a prospective technology that continues to be developed for the cultivation and production of biomass and plant secondary metabolites. One of the most effective methods to overcome this problem is micropropagation using adventitious root culture because it shows a faster growth rate in the production of active compounds, reduces geotropism problems, fast root branch growth, and a good level of genetic stability (Murthy *et al*., 2006).

One of the ways to optimize the increase in biomass and secondary metabolites is elicitation. The use of elicitors can increase biomass and secondary metabolite production in plant tissue culture and has been demonstrated in various plants (Sivanandhan *et al*., 2012; Zhao *et al*., 2010; Baskaran *et al*., 2012). The use of biotic elicitors in increasing secondary metabolites has been carried out (Le *et al*., 2018; Qiu *et al*., 2021; Gai *et al*., 2019).

Chitosan is a biotic elicitor which is a natural biopolymer modified from chitin which is commonly applied for various purposes such as a plant growth promoter, a natural biopesticide to protect plants from bacterial and fungal attacks, and as a coating material for various plant seeds (Uthairatanakij *et al*., 2007). Chitosan has a wide scope of use, is non-toxic, easily degraded, and raw materials come from nature (Hidangmayum *et al*., 2018). In addition, chitosan

regulates the plant's immune system and causes the excretion of enzymes and protective solutions, such as proline.

This literature review presents an overview of the effect of elicitation of chitosan on the productivity of biomass and secondary metabolites in adventitious root culture in vitro on various types of plants on an industrial scale to support various advances in the industrial sector.