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EFFICACY OF BACTERIA ISOLATED FROM ASYMPTOMATIC RICE LEAVES AS BIOLOGICAL CONTROL AGENT FOR BACTERIAL LEAF BLIGHT OF RICE

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ABSTRACT

Biological controls have been considered among the promising disease management strategies for sustainable agriculture as it could reduce the reliance on synthetic pesticides, overcome the problem of pesticide resistance, minimize the negative impact on the environment and non-target organisms and improve workers safety, whereas at the same time maintaining the economic viability of crop production. This study was conducted to isolate beneficial bacteria from asymptomatic rice plants and to screen it potential via *in vitro* and *in vivo* conditions for controlling bacterial leaf blight (BLB) disease. The current study found that *Bacillus subtilis* isolated from asymptomatic rice plants has exhibited high potential as a biological control agent (BCA) to manage bacterial leaf blight disease in rice caused by *Xanthomonas oryzae* pv. *oryzae* (Xoo). The finding revealed that the isolated bacterium was identified as *Bacillus subtilis*. Rice plants treated with this bacterium prior to BLB pathogen inoculation exhibited less severe symptoms of BLB disease as shown by disease severity index (DSI) 3.4 compared to 8.4 for rice plants treated only with the pathogen. Further evaluation under *in vivo* conditions showed the *B. subtilis* isolate capable to reduce severity of BLB disease symptoms on the treated rice plants either by preventive or curative approaches. The beneficial bacterium also has the capability to promote plant growth. Utilization of *B. subtilis* as a biological control agent to overcome BLB disease in rice plants could provide a greented approaches for rice farmers in Malaysia. The effective and economic development of a reliable formulation and delivery techniques of *B. subtilis* for applications in the rice fields are targets of future research to gear up the use of *B. subtilis* as a biological control product for BLB disease management.

ACKNOWLEDGEMENT

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CHAPTER ONE

INTRODUCTION

1.1   Research Background

Rice (*Oryza sativa*) belongs to the Poaceae family. In Malaysia, rice is considered as a major crop and a main source of diet. Rice farming can be considered as one of the first irrigated rice production systems which have been observed in Asia. Rice is produced mainly with an average farm size of 1.06 hectares (ha) by small holders (Malaysia, International Labor Organisation, 1976). According to Norsida and Sami (2009) there were approximately 116, 000 out of 296,000 rice growers in Malaysia which are full-time growers who depend on rice cultivation for their livelihood. Meanwhile, Department of Agriculture (DOA, 2002) recorded that cultivated rice throughout Malaysia was estimated around 672,000 ha and the average national rice production is 3.660 metric tonnes per hectare. Food and Agriculture Development (FAO, 2002) in Asia-Pacific Region, however, reported that the alarming inefficiency of rice production in Malaysia by comparing to other countries such as, Australia, where 1200 Australian rice growers produced 1.275 million tonnes of rice from the areas of 150,000 ha as compared to 150,000 rice growers in Malaysia with the planted areas of 676,700 ha only produced 2.091 million tonnes. There are many factors contributed to this result of rice yield reduction and one of them is pest and disease attack. A study conducted by Savary et al., (2000) found that 24-40% yield losses in tropical Asia due to insect pests and diseases.

Department of Agriculture Malaysia (DOA) (2000) reported that the total of rice harvested areas in different provinces reported as shown in Table 1. 1. The rice harvested areas can be divided into three major categories which are followed by their percentage harvested area. A first category is highly rice harvested areas which include Kedah, Sarawak, Perak and Kelantan. A second category is middle rice harvested areas which include Perlis, Sabah, Selangor, Pulau Pinang and Terengganu. While, the third category is lowest rice harvested areas which include Pahang, Melaka, Johor and Negeri Sembilan. Kedah has the highest rice harvested area which