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SCREENING THE POTENTIAL OF ANTAGONISTIC MICROORGANISMS AS BIOLOGICAL CONTROL AGENT FOR CONTROLLING RICE BLAST PATHOGEN, *PYRICULARIA ORYZAE*

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ABSTRACT

One of the major diseases that attack rice is blast disease, which has caused a great economic loss in rice productions worldwide. This disease is caused by the fungal pathogen known as *Pyricularia oryzae*. Besides of yield reduction, this disease considered important due to the problem of fungicide resistance. Fungal pathogen *P. oryzae* has already developed resistance to several active ingredients of fungicide such as carbendazium and tricyclazole. In order to tackle the problem of fungicide resistance, reduce the application of fungicides in the rice fields is crucial needed. Biological control could be an alternative method for controlling blast disease of rice, which also could reduce the load of chemical fungicides on the rice field. In this study, bacteria and fungi were isolated from asymptomatic rice leaves and stem and were tested for their antagonistic potential against *P. oryzae in vitro* and *in vivo*. A dual culture test was conducted as primary screening to evaluate all isolated bacteria and fungi for their potential as biological control of blast disease. Out of 58 bacteria isolates, four isolates showed antagonistic activity against the pathogenic fungus in the dual culture test. Isolate named as B2 (*Bacillus cereus*) showed the highest percentage of inhibition of radial growth with value of 58.16% as compared to isolate B1 (*Bacillus* sp.), B3 (*Bacillus* sp.), and B4 (*Bacillus* sp.) which PIRG value of 25%, 44.71%, and 54.32% respectively. In culture filtrate test, isolate B2 also shown the highest suppressing effect against the growth of *P. oryzae.* Secondary metabolite produced by isolate B2 significantly inhibited the growth of the pathogen with 40.58% of PIRG value as compared to the control plate. In addition, a study of isolate B2 on four week old rice seedlings inoculated with *P. oryzae* also showed a low disease incidence (25%) and percentage of disease severity index as low as 12.5%. Out of 37 fungi that were isolated, none of them showed antagonistic effect against *P. oryzae* in the dual culture test.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

Rice (*Oryza sativa* L.) is one of the essential cereal crops of family Poaceae that grown and produced in different kind of environments. It is a primary food around 60% in many countries of the world's population (Sowmya, 2001) and rice represents 30% of the world cereal production (Samuel S. Gnanamanickam, 2009b). Rice is one of the most important food crops worldwide, providing 35% to 60% of the dietary calories consumed by more than three billion people, and shouldering the responsibility for ensuring world food security (Xie, Zhang, Wang, Zheng, & Huang, 2006). It is one of the major consumed staple foods for a large part of the world's, especially in Asia. Rice provides more than 50% of the calories consumed in Myanmar, Cambodia, Bangladesh, Vietnam, and Laos and 20 to 44% in Sri Lanka, Thailand, Malaysia, Nepal, India and Philippines (Gianessi, 2014). Most of rice plant parts are utilized for human consumption and feed for animals. The rice bran contains high levels of protein and rice straw is available for ruminant feed after the rice was harvested. Rice is the third most widely planted crop in Malaysia after oil palm and rubber. In 2013, about 674 332 hectares of land were planted with rice including those that planted twice a year (Department of Agriculture, 2012). Due to its importance as Malaysian staple food, rice industries are receiving a lot of attentions from the government for food security. However, Malaysia only produces around 66% of rice for Malaysian consumption. The rice production in Malaysia is still far from self-sufficiency level needed for our food security.

Around 2 538 574 tons of rice produced in 2012 from 684 545 hectares of land in Malaysia that were cultivated with rice (Department of Agriculture, 2013) with the average production of rice around 3.7 tons per hectare. In contrast to Egypt, the country produced 9.7 tons of rice per hectare in 2012, which 2.62 times higher than Malaysia (Food and Agriculture Organization, 2013). The country produced 6 500 000