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GENETIC ANALYSIS OF F_2 POPULATION FROM CROSSES BETWEEN PONGSU SERIBU 2 AND MR264 ON BLAST DISEASE

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ABSTRACT

Rice blast caused by *Magnaporthe oryzae* is one of the most destructive diseases in rice production. Significant yield losses and decreasing rice productivity have become a major concern in rice breeding. Plant host disease is the most strategic and economical approach to control this disease. Crosses between Pongsu Seribu 2, a traditional resistant variety and MR264, a high yielding but susceptible to blast disease was developed to improvise new lines. About 157 SSR markers were used to identify the polymorphism between parental lines. Chi-square test ($\chi 2$) for a single gene model was applied for segregation analysis for both genotypic and phenotypic evaluation against blast disease. Agronomic traits were analyzed with correlation and regression analysis using Pearson test to indicate direct and indirect effects. Phenotyping segregation showed that the F_3 population demonstrated a good fit with expected test cross of 3:1 ratio for single gene model analysis ($\chi 2$= 1.239, P = 0.266). Genotyping segregation based on molecular data showed that the F_2 population demonstrated RM101, RM206, RM413 and RM495 showed good fit with expected test cross of 1:2:1 ratio for single gene model analysis with $\chi 2$=3.962, p=0.138; $\chi 2$=1.341, p=0.511; $\chi 2$=4.352, p=0.114; $\chi 2$=3.143, p=0.208, respectively. Regression analysis between the marker and phenotypic trait showed the positive association between these four polymorphic markers with 12% of phenotypic variation. Agronomic traits showed the positive direct effect of panicle number per plant, 1000-grain weight, number of grains per panicle, flag leaf length, and numbers of tiller per plant against grain yield per plant. The findings in this study revealed that the selected markers provide a valuable tool for resistance gene collection in rice. The use of host plant is an important stage to manage the disease. This study provided information on blast disease with potential new lines for future references. This study will help breeders to develop durable blast resistant rice varieties and farmer will able to manage the blast disease in future.

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TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 GENERAL INTRODUCTION

Rice (*Oryza sativa*) has become the essential food source to be consumed by half of the world's community. It contains the most important nutrition such as carbohydrates, protein, lipids, and minerals which are important for energy intake (Mohd Fairulnizal *et al.,* 2014). Malaysians consume rice as the main source of calories in daily life. Millions of people living in scarcity in Asia consume up to 50% of the dietary caloric from rice, thus, there is a serious need for food security (Muthayya *et al.,* 2014). In year 2015/2016, there were around 159.15 million hectares of rice cultivated area worldwide (USDA, 2017). In Malaysia, the cultivated area is 687,940 hectares which nearly meet 72% country's requirement (DOA, 2011). In order to obtain 810 million tons in 2025, increasing the yield has become the main concern for achieving the global rice need (Qu *et al.,* 2012). World population is increased and thus the demand for rice has become a major challenge in the future.

In Malaysia, Dasar Agromakanan Negara (DAN) 2011-2012, implemented by the Ministry of Agriculture (MOA) to ensure sufficient supply of food highlighted that local rice production should be increased to make sure sufficient country's rice stock (Yogambigai *et al.,* 2015). Despite all that, climate change, abiotic and biotic factors have become a major setback in controlling the rice production in rice world. Low production of the rice crops worldwide is due to the yield loss triggered by the blast disease. *Magnaporthe oryzae* is a fungal pathogen that causes blast disease resulting in approximately 50% yield losses (Khush and Jena, 2009; Nalley *et al.,* 2016). Blast disease is particularly responsible for disease in a rice field. Therefore, many researchers have tried to solve the annual loss caused by this disease whereby they have investigated the causal agent of this disease with different types of rice varieties.

Due to an attempt to solve this crisis, many methods have been used to control blast disease that spread in a rice field. Control measures are included burning or composting diseased tissue, using healthy seed, fertilizer management, cultural system, chemical control, forecasting system and resistant cultivar (Filippa *et al.,*