UNIVERSITI PUTRA MALAYSIA

SCREENING OF ANTAGONISTIC BACTERIA FOR BIOCONTROL ACTIVITIES AGAINST FUSARIUM OXYSPORUM AND GANODERMA BONINENSE

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BY

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CERTIFICATION FORM

This project report entitled "Screening Antagonistic Bacteria For Biocontrol Activities against *Fusarium oxysporum* and *Ganoderma boninense*" is prepared by Nurul Ashiqin Binti Mat Nawi and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

Ganoderma boninense is a fungus that is pathogenic on oil palms causing basal stem rot and most destructive disease of oil palm in South-East Asia. Meanwhile, *Fusarium oxysporum* is a causal agent of *Fusarium* wilt which affects a broad range of plants including black pepper, cucumber, banana and tomato. This study determined the potential of antagonistic bacteria that inhibited againts *G.boninense* and *F.oxysporum* growth. Five types of bacteria isolates, BLH, B38, B40, B41 and B43 were used for screening of their antagonistic activity againts *G.boninense* and *F.oxysporum.* The bacteria isolates were screened for *in vitro* antagonistic activity towards both fungal, *G.boninense* and *F.oxysporum* through dual culture and culture filtrate test/ diffusible antibiotic. The result showed that all of the bacteria isolates inhibited the growth of *F.oxysporum* and *G.boninense* with percentage of inhibition radial growth (PIRG) values ranging from 47.57 to 63.78% and 38.8 to 62.0%. Isolates B43 showed highest antagonism against *F.oxysporum* and *G.boninense* mycelia with 83.19 and 97.37% in culture filtrate test. The antifungal activities apparently involved the secretion diffusible bioactive compounds. Information obtained from this study showe the potential of B43 as biocontrol agent against *G. boninense* and *F.oxysporum*. It might be an economical as well as environmental save way to suppress the diseases.

ABSTRAK

Ganoderma boninense adalah kulat yang patogenik terhadap kelapa sawit yang menyebabkan reput pangkal batang dan merupakan penyakit yang paling merosakkan kelapa sawit di Asia Tenggara. Sementara itu, *Fusarium oxysporum* adalah agen penyebab bagi penyakit layu *Fusarium* yang memberi kesan penyakit kepada pelbagai tumbuhan termasuk lada hitam, timun, pisang dan tomato. Kajian ini adalah untuk menentukan bakteria antagonis yang berpotensi untuk merencatkan pertumbuhan *G.boninense* dan *F.oxysporum*. Lima jenis pencilan bakteria iaitu BLH, B38, B40, B41 dan B43 telah digunakan untuk menguji aktiviti antagonis terhadap *G.boninense* dan *F.oxysporum*. Setiap bakteria telah disaring bagi aktiviti antagonis secara vitro terhadap kedua-dua kulat melalui kultur dual dan ujian turasan kultur/antibiotik resap. Hasil menunjukkan bahawa semua bakteria telah merencatkan pertumbuhan *F.oxysporum* dan *G.boninense* dengan peratusan pertumbuhan perencatan jejari (PIRG) nilai-nilai diantara 47,57-63,78% dan 38,8-62,0%. Bakteria B43 menunjukkan aktiviti antagonis yang paling tertinggi terhadap miselia *F.oxysporum* dan *G.boninense* dengan 83,19 dan 97.37% bagi ujian turasan kultur. Aktiviti antikulat menunjukkan penglibatan rembesan resap sebatian bioaktif. Maklumat yang diperoleh daripada kajian ini menunjukkan bahawa potensi B43 sebagai agen kawalan biologi terhadap *G. boninense* dan *F.oxysporum*. Ia mungkin menjadi lebih ekonomik terhadap alam sekitar dan merupakan cara yang menjimatkan untuk menyekat penyakit.

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CHAPTER 1

INTRODUCTION

Biological control of plants diseases offers a safer and ecologically acceptable alternative to chemical control. The introduction and establishment of living natural enemies of pathogens is viewed as a powerful alternative to chemical fungicides conventionally used in agriculture, satisfying the preference of consumers for sustainable products with few or no chemical residues (Gnanamanickam *et al*., 2002). A variety of promising biological control agents belonging to various genera of bacteria such as *Bacillus, Pseduomonas, Agribacterium, Burkholderia,* other than fungi such as *Trichoderma* have been isolated, characterized and proposed for practical applications and some have been registered as biopesticides in order to reduce biotic damage due to soil borne diseases (Pane *et al*., 2012). There are many studies that reported the potential of *Bacillus* species as biocontrol agent that inhibit fungal growth. The *Bacillus* spp. produce endospores that are resistant to desiccation, heat, UV irradiation and organic solvents. The qualities make them more resistant to adverse weather conditions.

Fusarium wilt is a fungal disease which affects a broad range of plants such as tomato, banana (*Musa* spp.), cucumber and black pepper (*Piper nigrum*). *Fusarium oxysporum* infects commercial crops such banana (Mohammad *et al*, 2011), chickpea (Kaur *et al*, 2007), cumin (Haggag and Abo-Sedera, 2005), kidney bean (El-Mehalawy, 2004) and strawberry (Hyeon *et al*, 2009) and tomato (Chandel *et al*., 2009). The soil-borne tomato root-infecting pathogens *Fusarium oxysporum* f.sp.*lycopersic*i is particularly difficult to control using standard cultural and chemical methods (Chandel *et*

al,. 2009). Wilt resistant varieties of tomato are available, but in the past resistance have been overcome by the appearance of new races of the pathogen, a continuous problem in crop production (Hausbeck and Lamour, 2004). Growing awareness of the potential hazards in using agrochemicals has lead to increased investment in research on alternative methods for effective disease control.

Elais guineesis Jacq., which is commonly known as the oil palm is the most crucial species in the genus Elaies which belongs to the family Palmae. Oil palm is truly "a golden crop of Malaysia" since it generates profitable export earnings for the country and as a nature gift for poverty in Malaysia (Basiron, 2007). According to Principle Statistic of Oil Palm Malaysia, in 2010 the planted area for oil palm in Malaysia is 4.202 million hectares. Production increased from 94000 tones in 1960 to 15 million tones in 2005, or almost 160 times within 45 years. This represents a compound annual growth of 11.93 % per year (Basiron, 2007). Plant health is crucial in obtaining maximum production. In Malaysia, Basal Stem Rot caused by *Ganodema boninese* is attacking the oil palm. With no known cure at present, it is the major disease of oil plam and therefore of great economic importance to the Malaysian oil palm industry (Sapak *et al*, 2008).

The objective of this study is to screen the bacteria that can inhibit the growth of *Ganoderma boninense* and *Fusarium oxysporum*.

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