METARHIZIUM ANISOPLIAE METCH. SORROKIN AS A POTENTIAL MICROBIAL CONTROL AGENT AGAINST THE GERMAN COCKROACH, *BLATTELLA GERMANICA* (L.) (DICTYOPTERA:BLATTELLIDAE)

By

RADEN ISRA WARDANI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in fulfillment of the Requirements for the Degree of Master of Science

November 2004

Bismillahirrahmanirrahim

I dedicated this Thesis to my beloved parents

H.R. Iswandi and Hj. Chairani ,

my dearest wife and my daughter

Makhrani Sari Mustafa and Rr. Irdhina Mirza Sahirah

Brother and sister, brother and sister in-law, nephew and nieces

Thanks for giving so much love and understanding

Alhamdulillahirabbil 'alamiin

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master Science

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Supervisor : Professor Ahmad Said Sajap, Ph. D.

Faculty : Forestry

The German cockroach, *Blatella germanica* (L) is an important urban insect pest in many parts the world. In Malaysia, It is abundant in hotels and food preparative outlets. Several methods are being used to control this pest and the most common method is using chemical insecticides. The use of chemical for controlling cockroaches , however, has incurred a serious drawback. The cockroach population in many parts of the world developed resistant to chemical insecticides. Thus alternative methods for controlling are warranted. One of these methods is the use of biological agents such as entomopathogenic fungus, *Metarhizium anisopliae.*

In this study eleven indigenous isolates of *M. anisopliae* were evaluated for their pathogenicity to adult male of German cockroach. Monoconidial cultures of the isolates were obtained from soil and insect cadaver that were collected from various localities in Malaysia and were maintained on Potatoes Dextrose Agar+Yeast (PDAY).

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The result from the screening test shows that from eleven isolates tested, HSAH gave the best result with 87.5% mortality after 13 days inoculation and LT_{50} values of 6.78 days. Although not significantly different, there was a tendency for mortality on nymphs to be higher than mortality on adult males and females.

Further bioassay on four selected isolates, HSAH, Mam, Ckrk, LPR3, shows that the infectivity of the fungus varied with the isolates and dosages to which the cockroaches were exposed. The ED_{50} values ranged from 2.73×10^{9} to 3.15×10^{11} at day 4 after inoculation and 4.19×10^{3} to 1.22×10^{6} at day 14 after inoculation, the LT_{50} values ranged from 12.37 to 16.45.

The result evidently shows that HSAH isolate was the prominent isolate. Using HSAH isolate to control a cockroach colony, the result shows that highest mortality of 78.5 % was achieved when a colony of 50 insects were used and with dosage of 10:90. The same level of mortality i.e 78.5 % could not be achieved by a colony of 100 insects when applied with a dosage of 10:90. Apparently with a bigger cockroach colony, a higher dosage of fungus was required to kill *B. germanica*.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

METARHIZIUM ANISOPLIAE METCH. SORROKIN SEBAGAI EJEN KAWALAN MIKROBIAL YANG POTENSIAL UNTUK MENGAWAL LIPAS GERMAN, *BLATTELLA GERMANICA* (L.) (DICTYOPTERA : BLATTELIDAE)

Oleh

RADEN ISRA WARDANI

November 2004

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Lipas german, *Blattella germanica* (L.) adalah serangga perosak bandaran yang sangat penting diserata dunia. Di Malaysia *B. germanica* banyak dijumpai di hotel-hotel dan gerai-gerai makan. Ada pelbagai cara untuk mengawal perosak tersebut, seperti penggunaan racun perosak. Walau bagai manapun cara tersebut kini menimbulkan kesan sampingan iaitu lipas membentuk ketahanan terhadap racun. Salah satu cara untuk mengawal lipas tersebut selain menggunakan racun perosak kimia adalah dengan menggunakan kulat pathogen serangga iaitu kulat *Metarhizium anisopliae* .

Ada sebelas asal pencilan kulat *M. anisopliae* yang sudah diselidiki keberkesanannya kepada serangga jantan dewasa lipas german. Pencilan kulat yang dijumpai dari tanah dan serangga contoh yang dijangkiti dari beberapa lokasi telahpun diperkembang biakkan ke atas dekstros kentang agar + ragi (PDAY). Hasil dari uji pemilihan pencilan kulat

yang berasal dari sebelas pencilan yang telah diuji kaji, pencilan kulat HSAH telah memberikan hasil yang baik (87,5 % kematian serangga sesudah 13 hari dijangkiti) dengan LT_{50} pada 7.18 hari. Kematian adalah berkesan dan tidak ada hubung kait pada jantina dan tingkatan umur yang di akibatkan oleh *M. anisopliae* . Walaupun tidak menunjukkan perbezaan yang bererti, kematian keatas nim adalah cenderung tinggi berbanding kematian dewasa jantan dan betina.

Keberkesanan yang disebabkan oleh pendedahan kepekatan konidia kulat *M. anisoplia* kepada *B. germanica* berbeza mengikut pencilan kulat , yang mana ED_{50} strain HSAH menunjukkan nilai 4.190×10^3 pada14 hari sesudah jangkitan dengan kematian sebanyak 92.5 %.

Kesan dari dua bilangan koloni iaitu 50 dan 100 ekor lipas perkoloni dan kesan dos 1:99 dan 10:90, pada satu minggu selepas jangkitan, tidak menunjukkan perbezaan bererti diantara rawatan. Bagaimanapun rawatan tersebut menunjukkan perbezaan yang bererti dengan kawalan . Peningkatan kematian pada lipas berlaku pada empat minggu sesudah dijangkiti pada semua rawatan. Kematian tertinggi yang dicapai adalah sebanyak 78.5 % pada bilangan kolini 50 serangga dan dos 10:90. Kematian 78.5 % tidak dapat tercapai pada bilangan koloni 100 serangga yang diberi dos 10:90. Ini menunjukkan semakin besar bilangan koloni semakin banyak dos kulat yang diperlukan untuk membunuh *B. germanica*.

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I certify that examination Committee met on 21st October 2004 to conduct the final examination of Raden Isra Wardani on his Master of Science thesis entitled "*Metarhizium anisopliae* Metch. Sorrokin as A Potential Microbial Control Agent Against the German Cockroach, *Blattella germanica* (L.)(Dictyoptera : Blattellidae)" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that candidate be awarded the relevant degree. Members of the Examination Committee are as follows :

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DECLARATION FORM

I hereby declare that the thesis is based on my original work expect for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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RADEN ISRA WARDANI

Date:

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