

**BIOINSECTICIDE PRODUCTION FROM STEMONA EXTRACT
AND ITS APPLICATION IN AGRICULTURAL USE**



THANAPAT SASTRARUJI

**A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN ENVIRONMENTAL SCIENCE**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

**THE GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
NOVEMBER 2006
ISBN 974-9896-28-9**

**BIOINSECTICIDE PRODUCTION FROM STEMONA EXTRACT
AND ITS APPLICATION IN AGRICULTURAL USE**

THANAPAT SASTRARUJI

THIS THESIS HAS BEEN APPROVED
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN ENVIRONMENTAL SCIENCE

EXAMINING COMMITTEE

A. Jatis
.....
Assoc. Prof. Dr. Araya Jatisatiern CHAIRPERSON

S. Pyne
.....
Prof. Dr. Stephen G. Pyne MEMBER

Danuwat Peng-ont
.....
Assoc. Prof. Danuwat Peng-ont MEMBER

C. Jaisri
.....
Asst. Prof. Dr. Chaiwat Jatisatiern MEMBER

Alison Ung
.....
Dr. Alison T. Ung MEMBER

D. Supyen
.....
Dr. Damrat Supyen MEMBER

17 November 2006

© Copyright by the Chiang Mai University

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to my beloved supervisor, Assoc. Prof. Dr. Araya Jatisatiernr, for her support, valuable suggestion and kindness throughout this period of time of Ph.D. study. Especially for many lessons that taught me to realize the true meaning of the word “PhD”.

My sincere thanks are expressed to Asst. Prof. Dr. Chaiwat Jatisatiernr for his valuable advice, support and kindness. I also thank Dr. Damrat Supyen, and Assoc. Prof. Danuwat Peng-ont for their valuable suggestions and patience.

Special thanks to Prof. Stephen G. Pyne for providing me a lot of awesome experiences outside my home country, valuable advices to clarify what good researcher should have, and also opportunities to use many laboratory equipment. Many thanks also to Dr. Alison T. Ung for her helpful, useful advice and her kindness like my senior relative.

I like to emphasize my gratefulness, Faculty of Science, Chiang Mai University, the Conservation and Utilization of Biodiversity Resources Program, Biology Department, Faculty of Science, Chiang Mai University, the Graduate School, Chiang Mai University, the University of Wollongong and the Department of Environmental Quality Promotion, Ministry of Natural Resources and Environment, Thailand, for their financial support of this project.

I also would like to thank the members of the Jatisatiernr and Pyne research groups for their friendship. I would like also to thank the staff in the Department of

Biology and Chemistry, Chiang Mai University and the Department of Chemistry, University of Wollongong.

Last but not least, thousand thanks are gratefully given to my family, especially my beloved grandmother, my uncle and my aunt and also my parents, Mr. Tanaitorn Sastraruji and Mrs. Ampai Sastraruji for their encouragements, their endless love, their financial support and their uncountable will power.

Thanapat Sastraruji



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved