# A MATHEMATICAL MODEL OF INTER-COLONY SPREAD OF AMERICAN FOULBROOD IN EUROPEAN HONEYBEES (APIS MELLIFERA L.)

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A SPECIAL PROBLEM SUBMITTED TO

THE FACULTY OF THE COLLEGE OF ARTS AND SCIENCES

UNIVERSITY OF THE PHILIPPINES LOS BAÑOS

IN PARTIAL FULFILLMENT OF THE

REQUIREMENT FOR THE DEGREE OF

BACHELOR OF SCIENCE

(Applied Mathematics)

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The Faculty of the Mathematics Division

Institute of Mathematical Sciences and Physics

College of Arts and Sciences U.P. Los Baños

hereby accepts the Special Problem entitled

**A MATHEMATICAL MODEL OF INTER-COLONY SPREAD OF AMERICAN
FOULBROOD IN EUROPEAN HONEYBEES (APIS MELLIFERA L.)**

by

KIEFFER P. SANTOS

In Partial Fulfillment of the Requirements for the Degree of

B.S. Applied Mathematics

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Date

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## BIOGRAPHICAL SKETCH

Born on August 30, 2001, in Makati City, Kieffer P. Santos is the eldest child of Antonio P. Santos and Ruth P. Santos, and sibling to Seymour P. Santos, Calahan P. Santos, and Austein P. Santos. Growing up, he received his primary education at Golden Lampstand Grade School in San Pedro, Laguna, followed by his secondary education at Immaculate Heart of Mary School, also in San Pedro. In September 2020, Kieffer embarked on his academic journey at the University of the Philippines Los Baños (UPLB), where he pursued a degree in BS Applied Mathematics. With a keen interest in mathematical applications, Kieffer is committed to leveraging his education to contribute meaningfully to his field and beyond.

KIEFFER P. SANTOS

# ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to several individuals who have contributed to my academic journey and the completion of this degree.

First and foremost, I extend my deepest appreciation to my parents, Antonio P. Santos and Ruth P. Santos, for their unwavering support, encouragement, and sacrifices throughout my education. Their guidance and belief in me have been my source of strength and motivation.

I am also grateful to my siblings, Seymour P. Santos, Calahan P. Santos, and Austein P. Santos, for their constant encouragement and understanding.

Additionally, I would like to thank the faculty and staff of Golden Lampstand Grade School and Immaculate Heart of Mary School for their dedication to nurturing my academic growth during my formative years.

Also, I am indebted to the University of the Philippines Los Baños (UPLB) for providing me with the opportunity to pursue my passion in Applied Mathematics and for fostering an enriching learning environment.

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To the ALMIGHTY FATHER, thank you for the guidance you gave me and to my prayers that you answered.

I love you all.

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# ABSTRACT

KIEFFER P. SANTOS, University of the Philippines Los Baños, June 2023

## A MATHEMATICAL MODEL OF INTER-COLONY SPREAD OF AMERICAN FOULBROOD IN EUROPEAN HONEYBEES (APIS MELLIFERA L.)

**Major Professor: Eduardo O. Jatulan**

American Foulbrood (AFB) poses a significant threat to European honeybee colonies worldwide, affecting both bee health and apiary productivity. In this study, we develop a mathematical model to investigate the inter-colony spread of AFB among European honeybee colonies. The model integrates factors influencing disease transmission dynamics, such as bee drifting and robbing. This mathematical model contributes to the advancement of our understanding of disease ecology in honeybee populations and represents a significant step forward in the quest for sustainable beekeeping practices and the preservation of honeybee populations.

**Mathematics Subject Classification (2020):** 92-10, 92B05, 92D25, 92D30, 92D50

**Keywords:** American Foulbrood (AFB), European honeybees (Apis mellifera L.), epidemiology, population dynamics

# Chapter 1

## INTRODUCTION

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