

SCUDEM IV 2019

PROBLEM CHOSEN: C

CHEMICAL ESPIONAGE

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INTRODUCTION

Mathematical modeling is the art of translating problems from an application area into tractable mathematical formulations whose theoretical and numerical analysis provides insight, answers, and guidance useful for the originating application.

We consider the mating behaviour of insects especially in Large Cabbage White Butterfly (*pieris brassicae*) which females secrete chemical signals in order to mate. And the male on the other hand *anti-aphrodisiacs* to dissuade other mates from the female. This has several implications including giving the female butterfly time for egg laying but also gives it the chance to be detected and followed to the spot of laying by wasps.

BACKGROUND

One major problem arising here is the death of the eggs as the *anti-aphrodisiacs* increases the chance of female butterflies to be traced and consequently have their eggs eaten up. This situation may lead to realistic decrease in population of the butterfly.

So, we develop a mathematical model for the interactions of these butterflies and the wasps. In a bid to finding the best balance for the system and what is likely to happen in the long run.

METHODS

We use the best of our knowledge of Biology and Mathematics: problem solving skills from Mathematics and factors from Biology. So, we got a reasonable and logical representation, from which calculation of variables can be carried out and arrive at provable and reliable results.

We had:

- [1] The logistic growth model
- [2] The prey-predator model

We consider the population of the butterflies and wasps as time-dependent variables. This got us our differential equations to describe this biological systems of the interaction of these two species.

CONCLUSIONS

The model, as a statement of fact can be relied on to get results accurately as long as the conditions given are not violated.