November 9, 2019 Coach: Reza Ahangar Texas A&M University- Kingsville

SCUDEM IV 2019 Problem C: Chemical Espionage

Team Members: Olivia Balderas, Leslie Perez, and Evina Moreno

To begin Problem C: Chemical Espionage, the group first had to breakdown the summary and questions that were included in the problem. The various assumptions that were drawn from the problem were that there are 100 female butterflies, 100 male butterflies, and 100 wasps (parasites). From this, the next assumption was that a female butterfly would lay about 60 eggs a year, and seventy percent of the female butterfly population will mate. However, twenty-eight percent of the mated female butterfly population will be latched on to by a parasitic wasp. The group's overall system can hold up to 10,000 butterflies in order to show the population growth of the species. Where, only twenty five percent of healthy eggs of the butterflies will survive which is an assumption that needs to be taken into consideration. The reason why our group made these executive assumptions was because the large cabbage white butterfly lays about an average of twenty to fifty eggs two times a year. Nina Fatouros, an associate professor in the Biosystematics group, had a study performed that showed a population of 28 female butterflies which was then latched on to by the neighboring wasp population. From this, the male butterflies will then release the anti - aphrodisiac however, only seventy percent of the female population will end up mating. However, not all the healthy butterfly eggs will survive long enough to become an adult butterfly. Now the rate of the butterfly growth was presented with the formula of the total equaling the birth of butterflies subtracted by the death of the butterflies. For one year, butterfly eggs laid about 4,200 eggs which were determined by the multiplication of seventy mated females by sixty eggs. Then the butterfly eggs had to be calculated for the amount that was infected with the parasite which was about 1,680 eggs which were determined by the multiplication of twenty-eight latched female butterflies by sixty eggs. From these values found

the main formula of the total equaled the birth of butterflies (4,200 eggs) subtracted by the death of the butterflies (1,680 eggs) which resulted in 2,520 eggs for the total. With the given rate formula the number of butterflies actually to survive to adulthood would be about 630 butterflies which was determined by taking the 2,520 births (eggs) subtracted by 1,890 deaths of the butterflies. From this result, the increase of population was then able to be determined which was about 315 % increase in the butterfly population. This was determined by dividing the surviving butterflies of 630 by 200 butterflies as the basis of the population. From this, our group was to draw the conclusion that the butterfly will grow at a rate of 315 %. From the data values found, the differential equations variables and equations were then able to be determined. After the values were able to be drawn from the differential equations calculations then a table was able to be made that represented population growth of the butterflies. The basis of the butterflies was about 200 butterflies that grew over time. Once the butterflies hit three years there were over 9,961 surviving butterflies in the population compared to the basis of 200 butterflies. The graph that was determined from the calculated data of the butterfly populations over the years was able to show the major growth of the butterflies from a basis of 200 exponentially. From this, the problem was able to show the mathematical model of the interactions of the male and female butterflies as well as the parasitic wasps which presented the best balance for this system and what will likely to happen in the long run to the butterfly population growth.

WORKS CITED

HUIGENS, M. E., WOELKE, J. B., PASHALIDOU, F. G., BUKOVINSZKY, T., SMID, H. M. AND FATOUROS, N. E.

Chemical espionage on species-specific butterfly anti-aphrodisiacs by hitchhiking Trichogramma wasps

In-text: (Huigens et al., 2019)

Your Bibliography: Huigens, M., Woelke, J., Pashalidou, F., Bukovinszky, T., Smid, H. and Fatouros, N. (2019). *Chemical espionage on species-specific butterfly anti-aphrodisiacs by hitchhiking Trichogramma wasps*. [online] Behavioral Ecology

Available at: https://academic.oup.com/beheco/article/21/3/470/219121

[Accessed 9 Nov. 2019].

AMINE KHAMSI, M.

Population Dynamics

In-text: (Amine Khamsi, 2019)

Your Bibliography: Amine Khamsi, M. (2019). *Population Dynamics*. [online] Sosmath.com.

Available at: http://www.sosmath.com/diffeq/first/application/population/population.html

[Accessed 9 Nov. 2019].

FATOUROS, N.

Anti-aphrodisiac Compounds of Male Butterflies Increase the Risk of Egg Parasitoid Attack by Inducing Plant Synomone Production

In-text: (Fatouros, 2019)

Your Bibliography: Fatouros, N. (2019). *Anti-aphrodisiac Compounds of Male Butterflies Increase the Risk of Egg Parasitoid Attack by Inducing Plant Synomone Production*. [online] springer.com.

Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2797620/

[Accessed 9 Nov. 2019].