HONEYBEE FLYABILITY

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INTRODUCTION

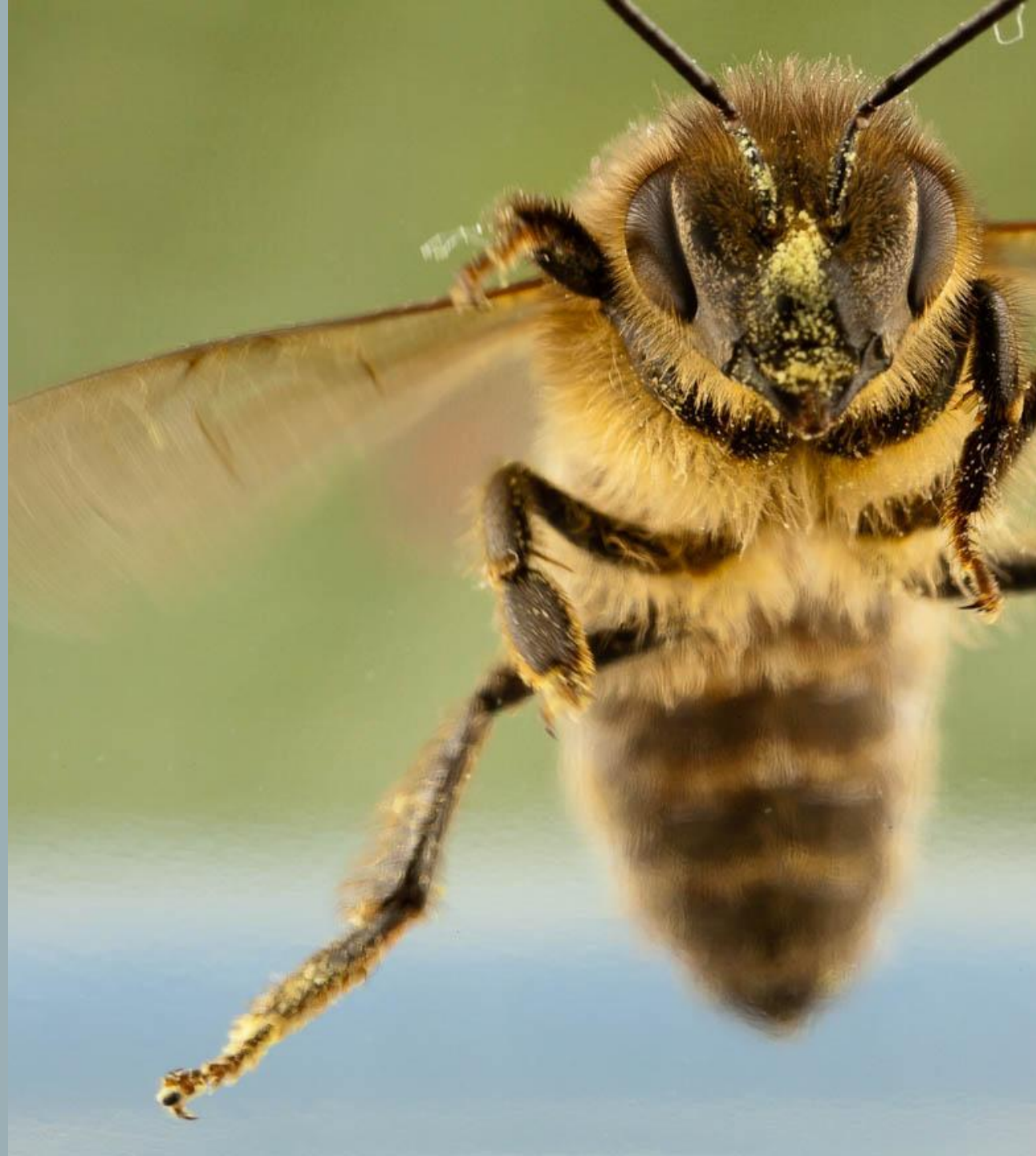
- Over the years the flight activity of honey bees have received very little attention despite their importance.
- The flight of honey bees are essential as it aids them in mating, and health of a colony.
- During a queen flight she will mate with multiple male drones. The sperm from each drone will fertilize hundreds of thousands of eggs, ensuring genetic diversity within the colony.

INTRODUCTION CONTINUED

- This study gives a better understanding of the distance and speed of honeybees as it relates to insemination.
- Also it gives researchers a better view on how they move through the environment and interact which can help researchers further various studies.
- Based on studies I hypothesized that non-inseminated queen bees will fly longer than inseminated. Also, that high biting bees would fly longer than low biting.

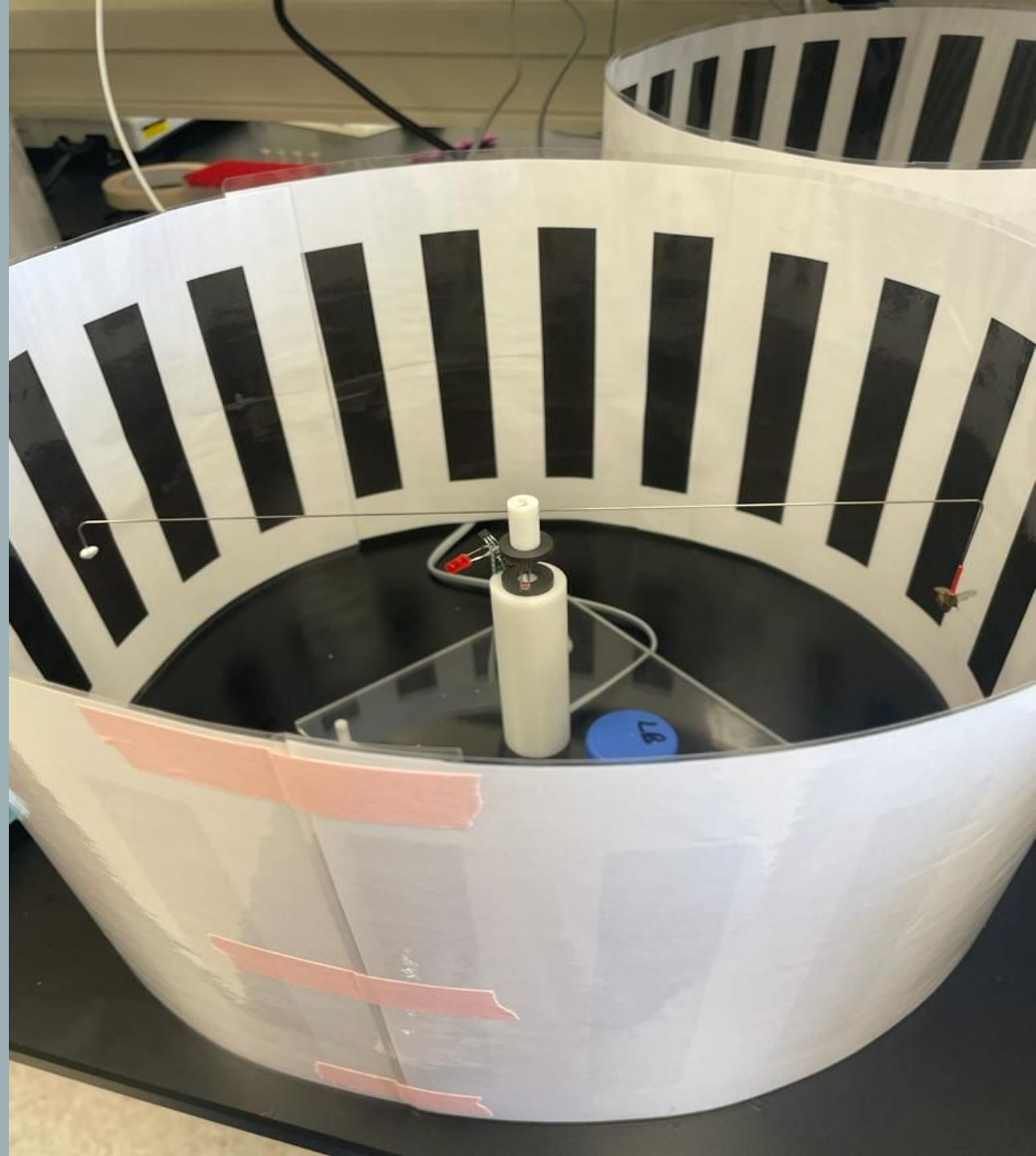
MATERIALS AND METHODS

- Loctite super glue, wire cutter, magnets, non-magnetic forceps, queen bees (inseminated and non-inseminated), worker bees (low biting and high biting), low and high biting queens, lamp, flight mill, razor, sugar water or honey, pipette, prototype2.21_FM_Acute 6CH_3.55 (lab view program), queen cage, worker cage, laminated vertical black striped paper walls, ice, plastic tubes, metal disc, clay, 2.0mm metal hole punch beadsmith, small brush, chronicle scissors, carbon dioxide and heater.



MATERIALS AND METHODS CONTINUED

- Experiment 1- Queen bees Flight ability
- Insemination of Virgin Queen Bees – Expose the vaginal orifice of the queen by separating the abdominal plates using a forceps. Lift up the sting structure and dorsally. Bypass the flap of tissue covering the median oviduct and insert the semen directly onto it. For this experiment 3ul was used. Used carbon dioxide to anesthetized or calm down the queens.
- Preparation for flight– Shave the hair off of the thorax of the bee and squeeze a tiny amount of super glue on it. Then using the non-magnetic forceps place the metal disc on the thorax of the bee. Gently tap the metal disc to ensure it is secure and allow to dry for two minutes.
- Starting the program – Start the lab view program then click generate, following the start recording button. Feed the bee 5 to 10 ul before flight and then attach the bee to the flight mill by the metal disc and then gently turn the mill by hand in which u should see a red light. The screen will update the time with each rotation. Copy data into desired folder. Run each queen on flight mil for 10 minutes



MATERIALS AND METHODS CONTINUED

- Experiment 2 – Low and high biting workers and Queens
- Preparation of Low and high biting workers and Queens for Flight – Utilizing the forceps collect the worker gently and place it into a test tube will holes to allow the bee to breathe. Following place, the tube on to ice for 1-2 minutes to allow the bee to calm down. After the bee has calm down remove the tube from the ice and gently shave the hair off the thorax of the bee. Once removed place a small amount of glue on the thorax ensuring that it does not get onto the bee wings. Place the metal disc onto the thorax and allow to dry for two minutes.
- Starting the program – Start the lab view program then click generate, following the start recording button. Feed the bee 5 to 10 ul before flight and then attach the bee to the flight mill by the metal disc and then gently turn the mill by hand in which u should see a red light. The screen will update the time with each rotation. Copy data into desired folder. Run each worker on the flight mil for 24 hours and the low and high biting queens for 10 minutes.

INSEMINATED VS NON-INSEMINATED QUEENS

Group	Distance	Total Time	Halt Time	Flying Time	Mean Velocity	Velocity Max
Non-Insemina ted Queen	90.1637m	340.814s	13.128s (4)	327.686s	0.13793m/s	0.521
Inseminated Queen	63.7743m	481.898s	38.467s (3)	443.431s	0.14314m/s	0.44248

Table 1: Results of inseminated and non-inseminated queens on flight mil for 10 minutes. Six queen bees were tested to compare flight and speed differences. Three of which were inseminated and three that were non-inseminated. After study it was shown that non-inseminated queens have a longer flying distance than those that are inseminated. While inseminated queens are seen to fly longer than those that were not inseminated.

LOW AND HIGH BITING QUEENS

Group	Distance	Total Time	Halt Time	Flying Time	Mean Velocity	Velocity Max
Low Biting Queen	240.332m	580.295s	33.385s	546.91s	0.40193m/s	0.45073
High Biting Queen	12.8805m	339.263s	559.036s	-219.773s	0.09349m/s	0.45663

Table 3: Data results of low and high biting queens after 10 minutes on the flight Mil. After ten minutes it was seen that the low biting queens had a greater distance and a higher velocity than the high biting queens.

LOW AND HIGH BITING WORKERS

Group	Distance	Total Time	Halt Time	Flying Time	Mean Velocity	Velocity Max
Low Biting Workers (Trial 1)	119.381m	5359.04s	37597s	-32238s	0.22658m/s	0.44624
High Biting Workers (Trial 1)	140.743m	51.5s	77964.8s	-77913.3s	0.35666m/s	0.77757
Low Biting Workers (Trial 2)	878.215m	85215.7s	483.591s	84732.1s	0.30881m/s	0.67273
High Biting Worker (Trial 2)	530.615m	11676.5s	3814.92	7861.54s	0.27799m/s	0.81178

Table 3: Results of low and high biting on flight Mil for 24 hours. First trial only two low biting flew while three high biting flew. It was seen that the high biting flew a longer distance than the low biting and had a greater speed. Second trial the low biting flew a longer distance than the high biting and had a higher speed.

VIDEO OF QUEEN BEE ON FLIGHT MIL

DISCUSSION

- Based on my results, it showed that non-inseminated queens have a longer flight time than inseminated queens.
- Also, low biting queens flew longer than high biting queens. My data also emphasized that in the first trial high biting workers fly longer than low biting while trial 2 showed that shows that low biting have a longer flight time than high biting workers. This can be due to various errors during the experiment such as hand touching flight mil causing it to move. Moreover, whether or not there was equal amount of bees flying each trial.

DISCUSSION CONTINUED

- During this experiment I faced numerous trials and error, however I was able to find the best time of leaving the bees on ice to calm them down and how to properly place the bee on the flight mil to reduce false data points.
- For future work I would run more trials of queens, high and low biting workers, and low and high biting queens to compare more data.

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