

Effect of temperature on the foraging behaviour of *Solenopsis invicta* (Hymenoptera: Formicidae)

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Introduction

- Natural or human-induced temperature changes may impose significant impact on behaviour of heat-sensitive terrestrial invertebrates in terms of food availability and individual survival¹.
- Recruitment occurs when pheromones were laid between food source and ant nest. As a result of swarm intelligence, where collective behaviour contributes to the most efficient way of foraging, the shortest trail is always formed under homogeneous conditions².
- Solenopsis invicta*, the red imported fire ants, is commonly found in urban and suburban areas. Foraging behaviours are demonstrated, and study has discovered an increase in foraging activity level with increasing temperature until around 45°C³, marking their average critical thermal maximum and the start of activity level decline.
- It is hypothesised that with increasing ground temperature, ants will show a stronger preference of the path with non-optimal length.

Aims

To investigate the changes in trail formation i.e. preferred branch of *S. invicta* during foraging with increasing ground temperature.

Methodology

Bridge models

- M1: both short branches
- M2: one short branch + one long branch (length ratio = 1:1.6)

Temperature monitoring

- Heating wire placed under the shorter branch of the bridge
- 3D printing material confirmed to be thermal conductive
- Calibrated and confirmed with temperature gun

Experiments

- Four distinct colonies acclimated for at least one week in lab
- Four treatments with three temperatures: 25°C, 40°C, 55°C
- Three trials per colony per treatment → total 48 sessions

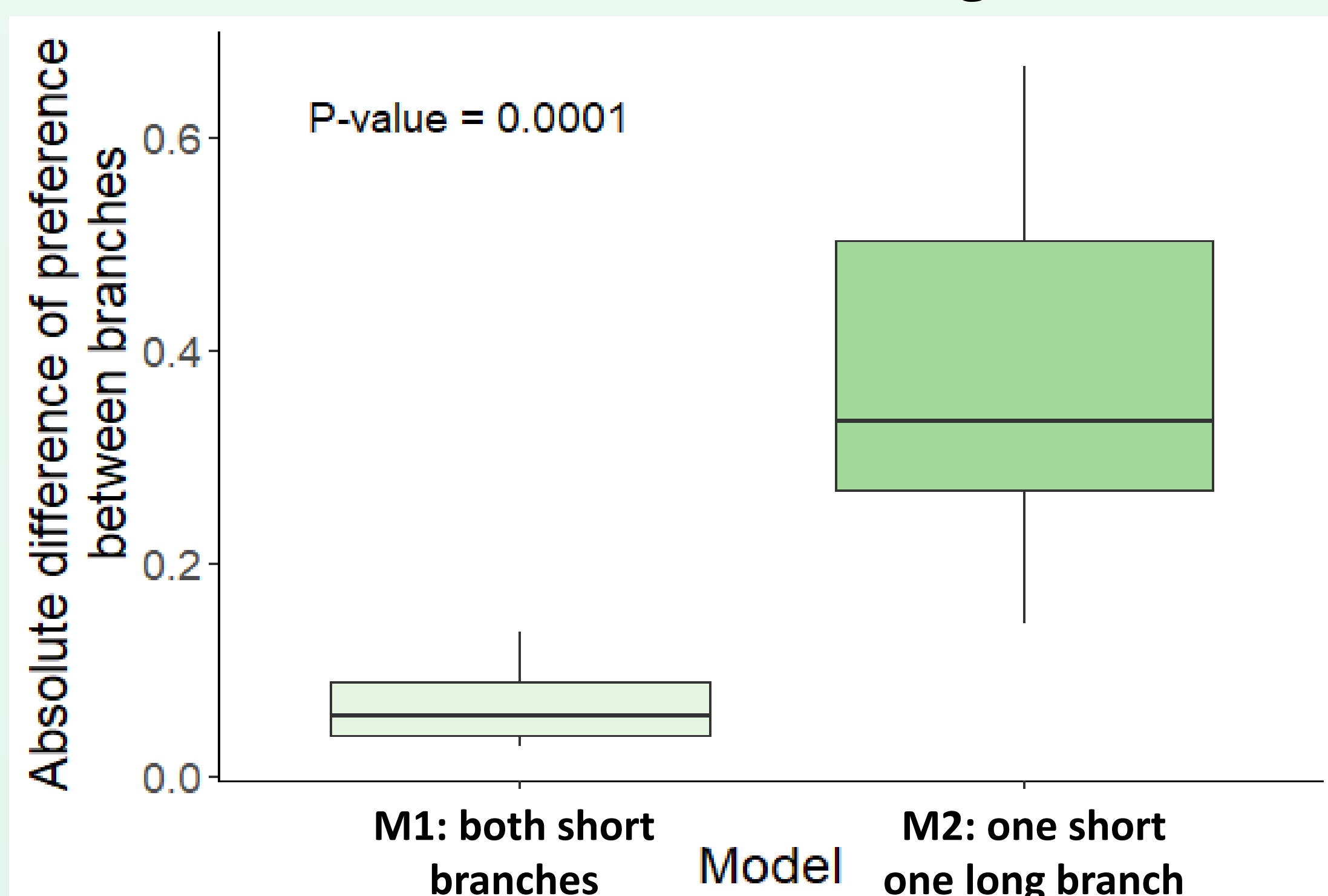
Measurement

- 10-minute videos taken 30 minutes after first contact with bait
- Count number of traffic and their respective choices on branch

Results

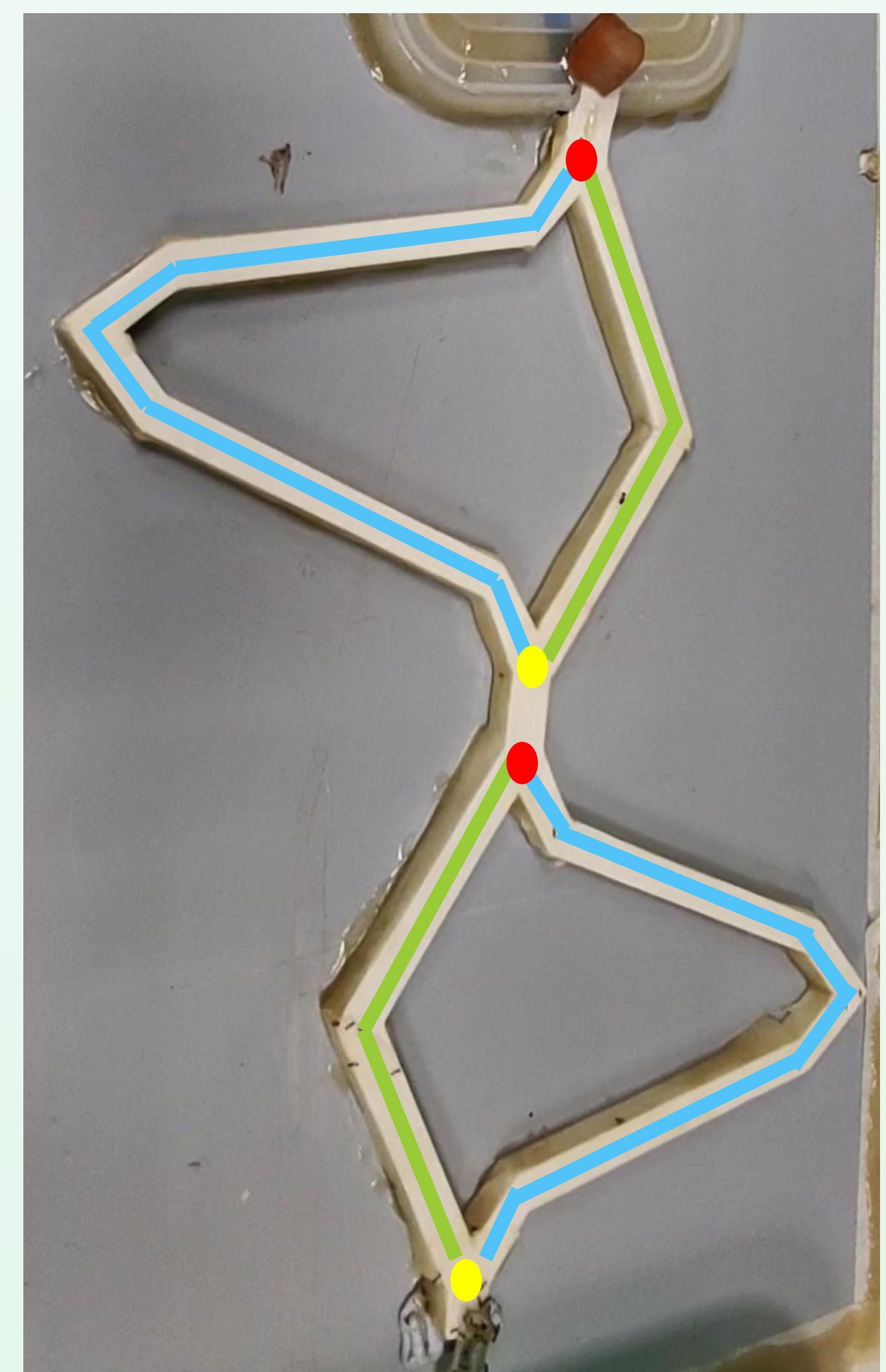
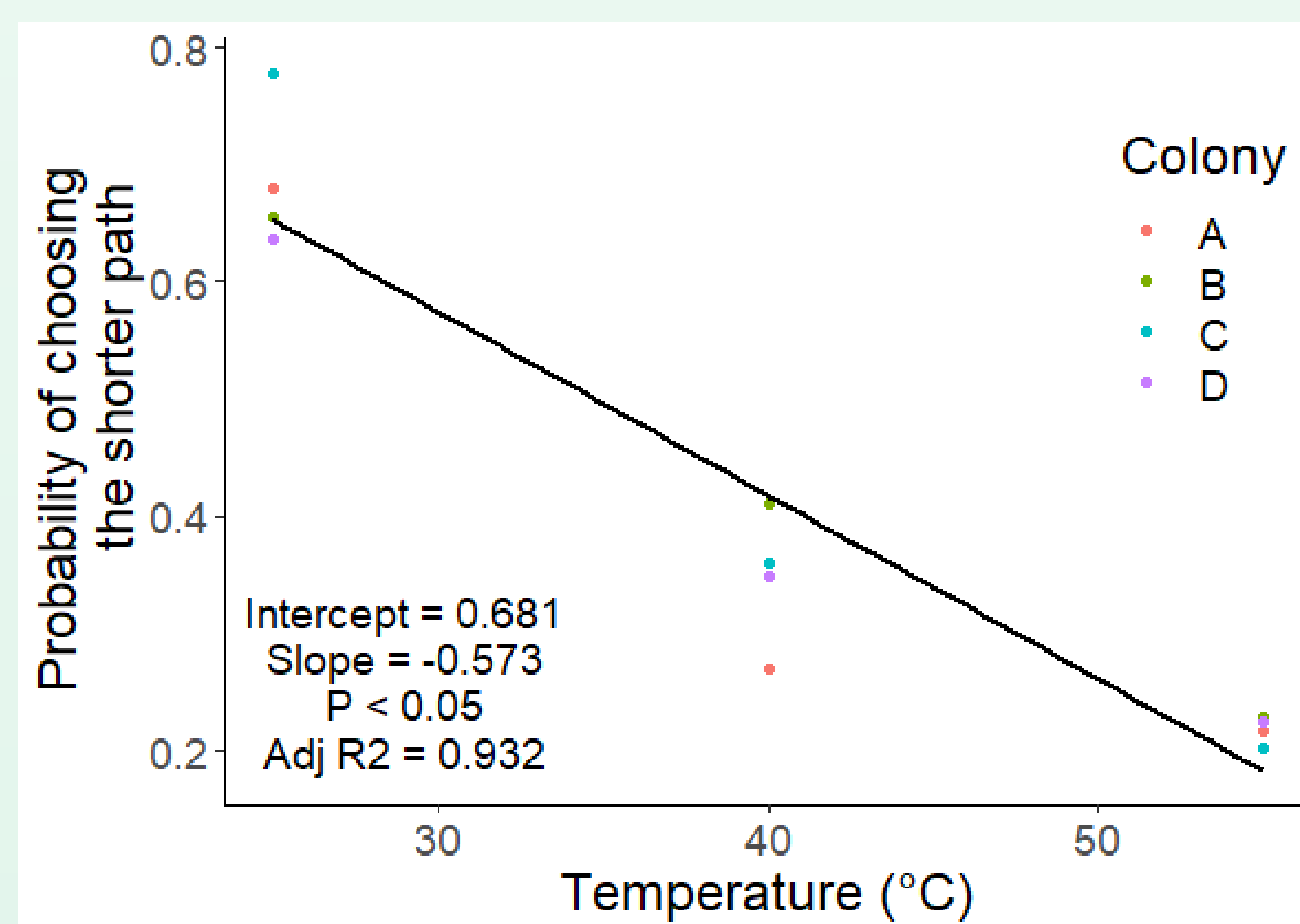
Part I

- Absolute difference of preference = $|P(\text{long}) - P(\text{short})|$
- When heated short branch and homogeneous long branch were given, there is significant preference on the **shorter branch** over the longer branch.



Part II

- Ground temperature determines path choice.
- When the optimal path (i.e. shorter branch) has **higher** ground temperature, ants prefer the **longer** branch at homogeneous temperature over the shorter branch.



Bridge model M2, with branches of different lengths. Shorter green branch is heated. Red and yellow dots as counting points.

Future investigations

- Finer scales of temperature to be used to identify the critical temperature of changing path preference.
- Scale of the experiment to be doubled to improve reliability and accuracy of data.
- Branches of different length ratios to be tested to see the additive effect of temperature and foraging distance.
- Speed of foragers at different temperatures to be investigated.

Conclusion

- Ground temperature is a determining factor of recruitment trail formation.
- Increase in ground temperature may lead to failure in trail formation, lowering foraging efficiency of colony.

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References

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