Is Less More? Alarm Pheromones for Aphid Parasitism

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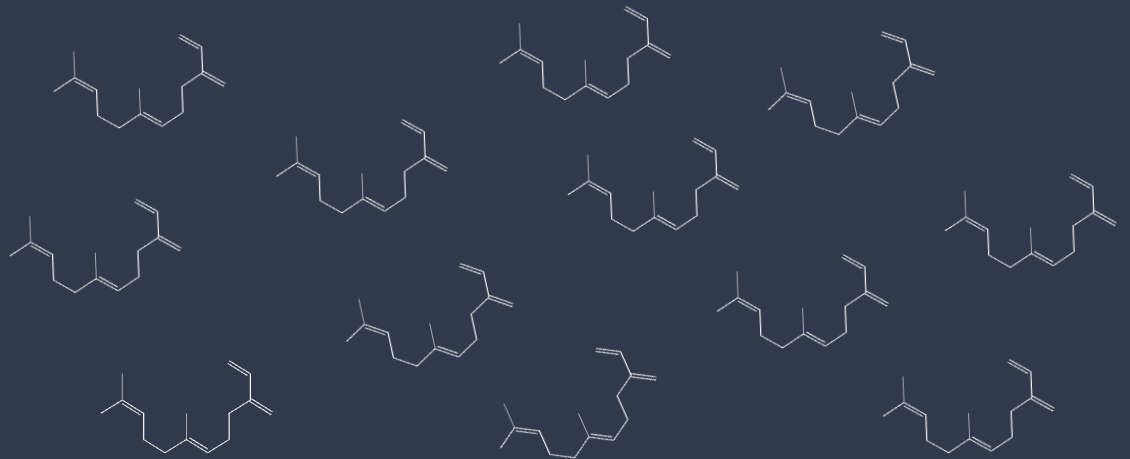
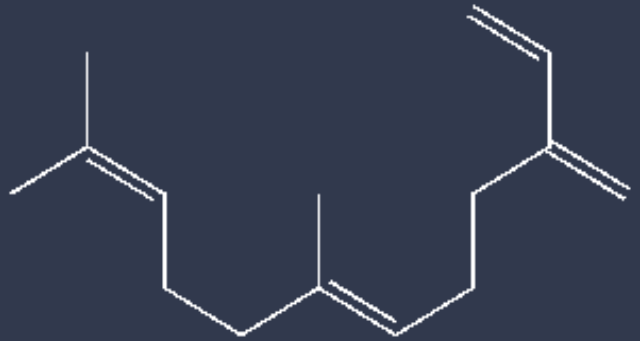
Honours Integrated Science II




DANGER
PESTICIDES
SPRAYED

Predation

Pheromone release as an alarm signal



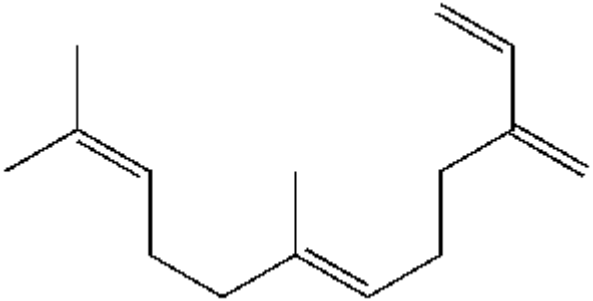
(E)-β-farnesene

(EβF)

Primary effect

Consumption

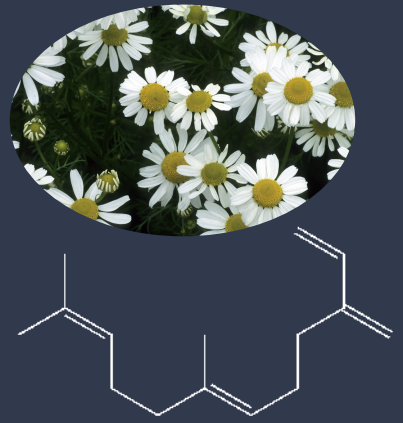
Secondary effect



EβF release

Question:

Does the frequency of chamomile oil application, containing EβF, to *Arabidopsis* impact the location of GPA on plants?



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= ?

Hypothesis

GPA location on *Arabidopsis* will be affected by the frequency of EβF exposure

Materials & Methods

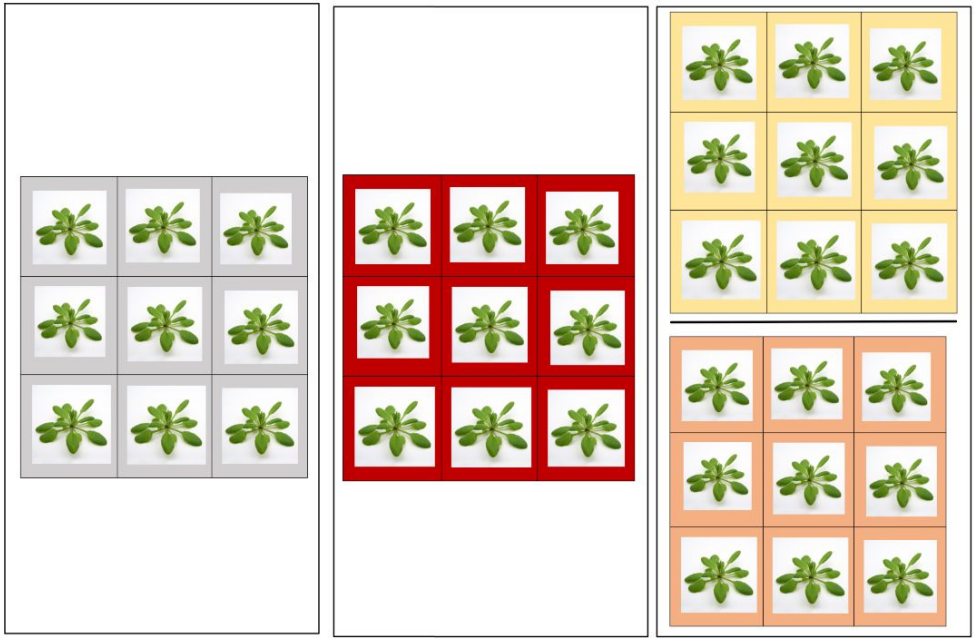
Arabidopsis

X 36

M. persicae
(GPA)

X 2
(per plant)

Treatment Levels



*over 12 days

Control - 0 EβF treatments

Low Frequency - 3 EβF treatments

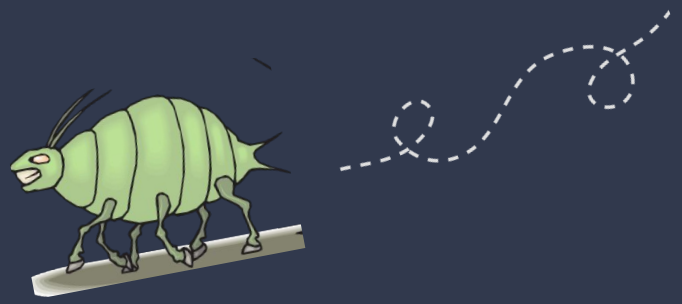
Medium Frequency - 4 EβF treatments

High Frequency - 7 EβF treatments

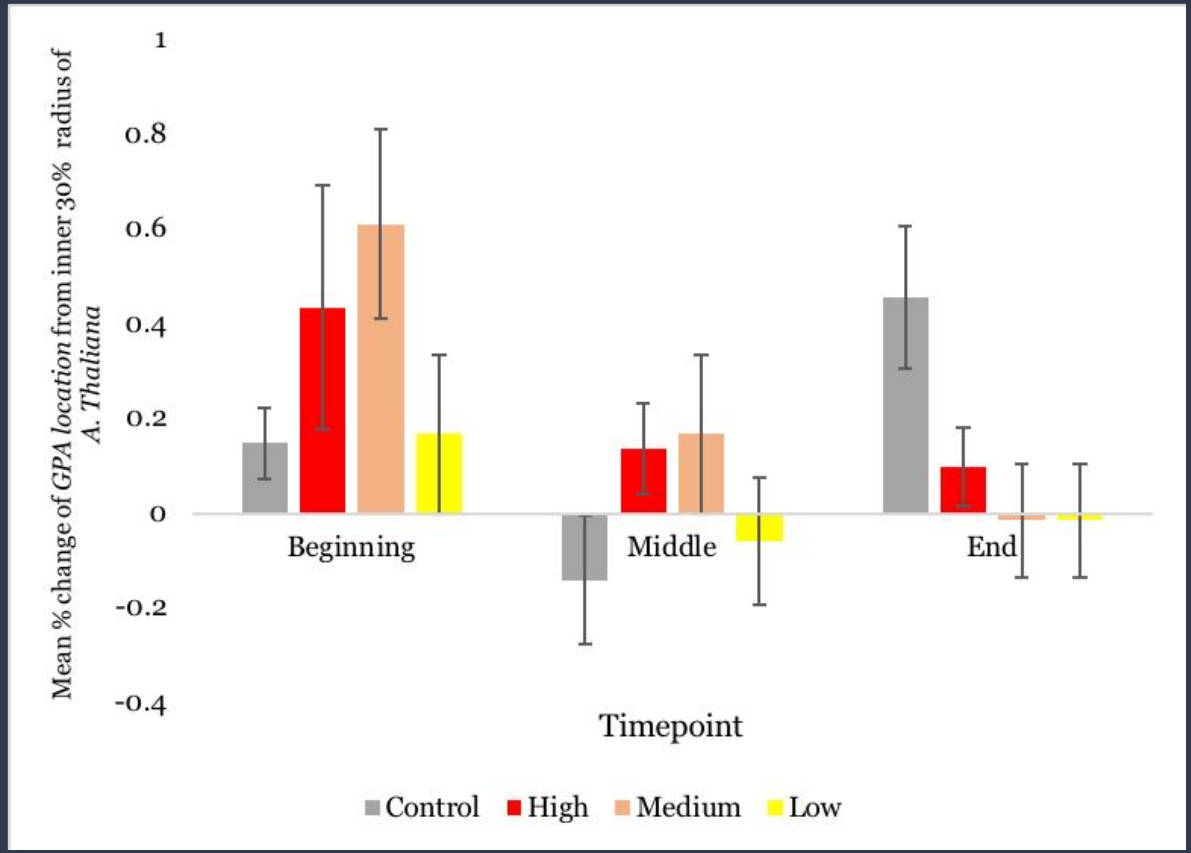
Treatment

Determination of inner 30% area on each plant

Percent change in location



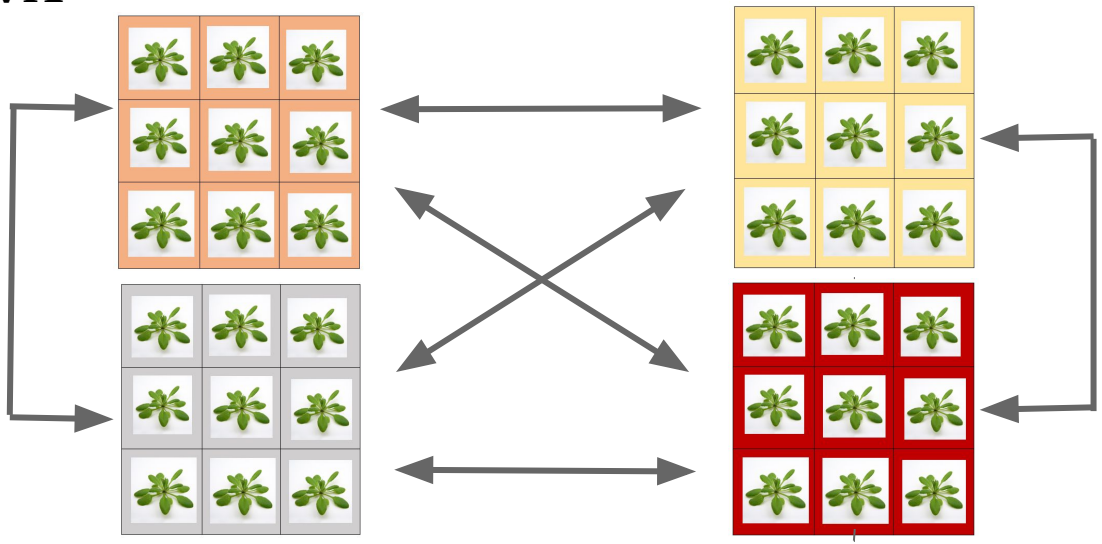
$$\frac{\text{\# GPA in inner 30\% radius before treatment - \# GPA in inner 30\% radius after treatment}}{\text{Total \# of GPA}} \times 100\%$$



Mean % change in GPA location 1 hour after treatment application, the error bars show standard error

Statistical Analyses

One-way ANOVA



Compare % change of GPA location during three distinct timepoints

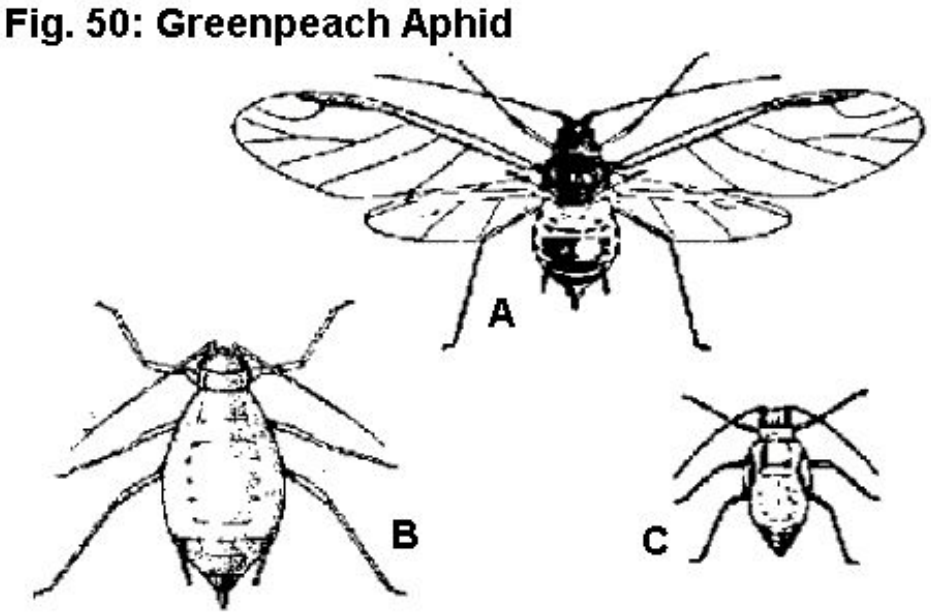
Results

Table 1: Summary of analyses of variance of percentage change *M. persicae* from the inner area of *A. thaliana*

	Beginning			Middle			End		
Df	MS	F	P	MS	F	P	MS	F	P
3	0.45	1.42	0.26	0.16	1.00	0.41	0.14	1.73	0.19

P > 0.05

Discussion – Life Cycle



A. Winged adult B. Wingless adult C. Young nymph

Discussion – Physical Stimulus

Thanatosis as a behavioural response

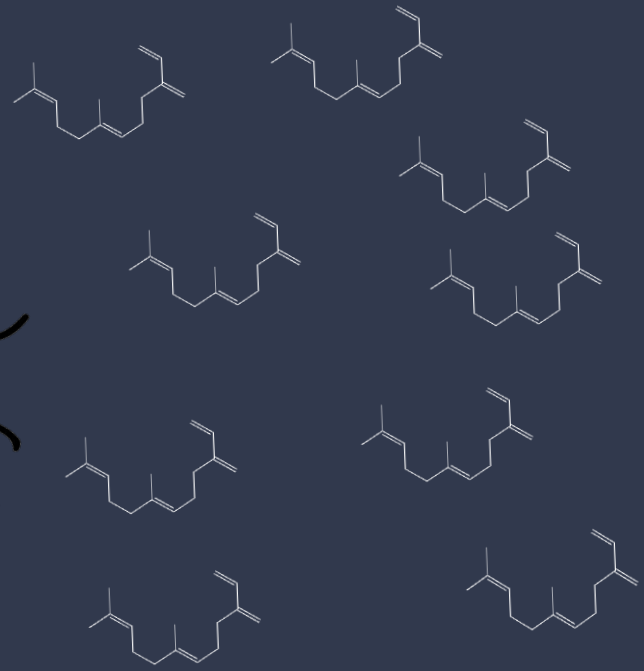
Discussion – Social Interaction

VS.

Large colonies

Isolation

Overall...



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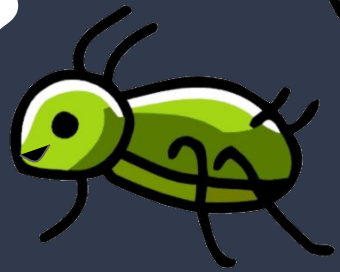

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General Summary...Questions?

- EβF is a volatile signal used by *M. persicae* to warn neighbouring individuals of the presence of a predator
    - EβF causes avoidance behaviours, including dropping of the plant
    - Potential use in pest control for crops
- Results from the ANOVA tests allowed us to accept our null hypothesis:

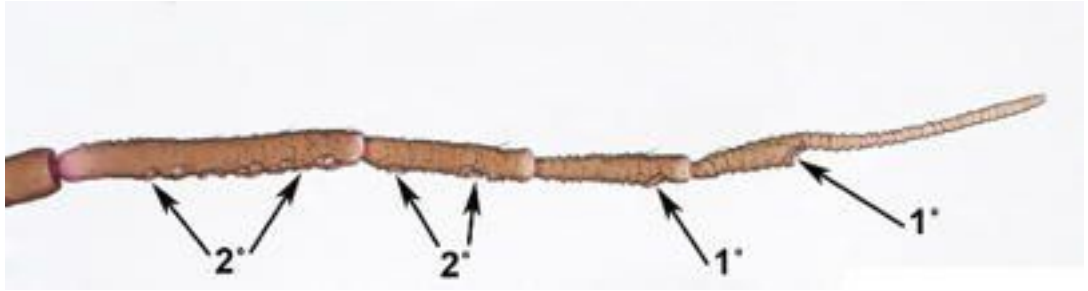
  EβF from chamomile oil introduced to *M. persicae* on Ar*abidopsis* plants had no significant impact on their behavioural patterns
- The phenomenon can be explained by their social interaction, physical stimuli, and life cycle traits

Formula for Percent Change of Aphid Movement

$$\frac{\text{\# aphids in inner 30\% before treatment - \# aphids in inner 30\% after treatment}}{\text{total \# of aphids}} \times 100\%$$

Acknowledgements

Discussion – Odour



Primary and secondary sensoria on antennae

Aphid secreting fluid from cornicles– which emits alarm pheromone

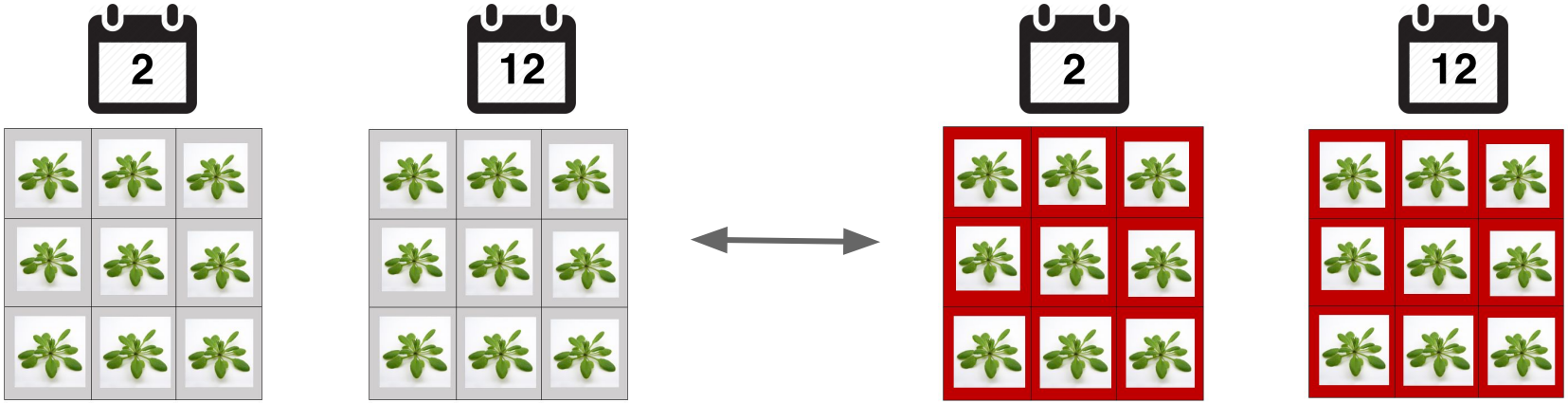
Treatment Schedule

Table 1. The course of the experiment depicting all four treatment levels over the 12 day experiment. No treatments were applied on days 1,3,4,10 or 11.

Day	Control (0 treatments)	Low Frequency (3 treatments)	Medium Frequency (4 treatments)	High Frequency (7 treatments)
1				
2	Ethanol	EβF	EβF	EβF
3				
4				
5	Ethanol	Ethanol	EβF	EβF
6	Ethanol	Ethanol	Ethanol	EβF
7	Ethanol	EβF	Ethanol	EβF
8	Ethanol	Ethanol	EβF	EβF
9	Ethanol	Ethanol	Ethanol	EβF
10				
11				
12	Ethanol	EβF	EβF	EβF

Statistical Analyses

One-way ANOVA
Set 2: Course of experiment



Compare change in aphid response between day 2 and 12 between all 4 treatments

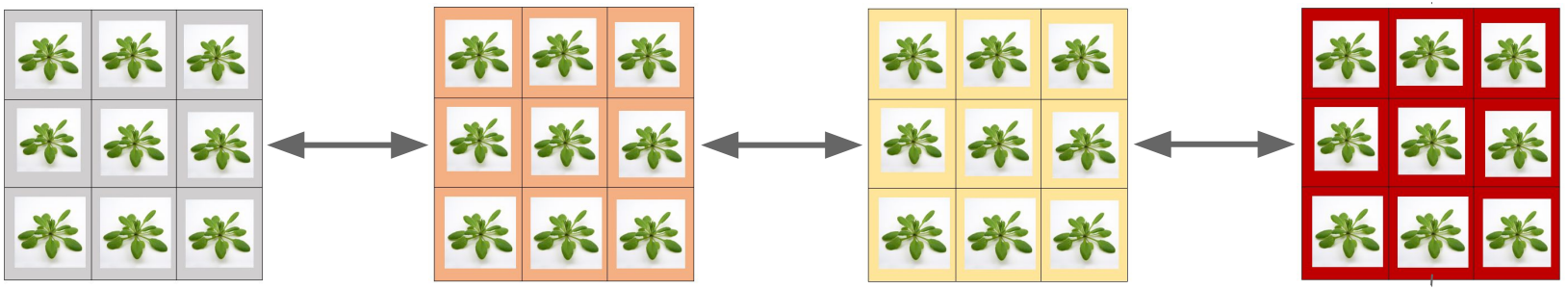
Results

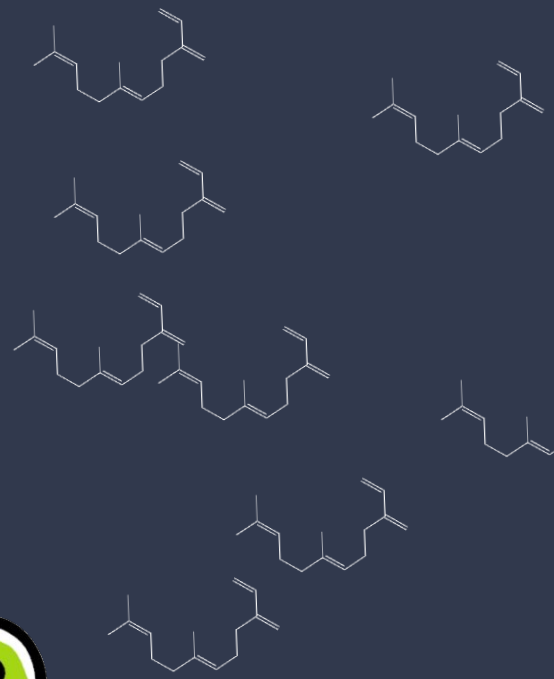
	Day 12 – Day 2		
Df	**MS**	**F**	**P**
3	0.61	1.89	0.16

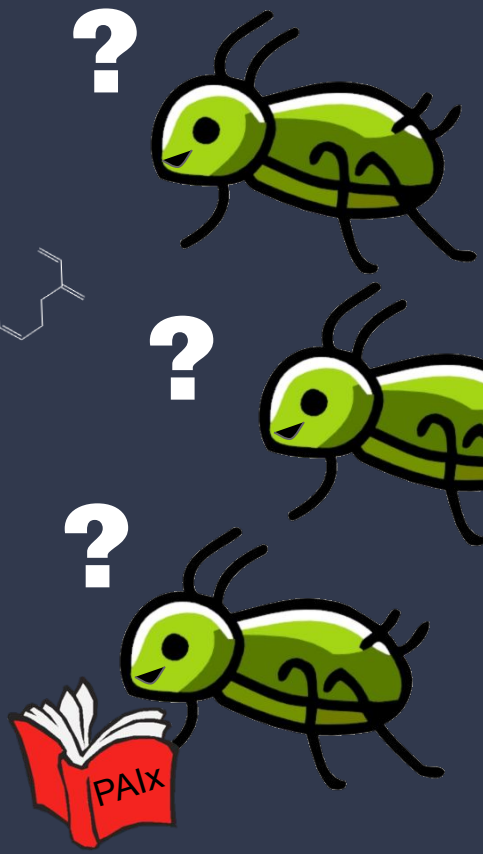
Table 2: Analysis of variance of M. persicae of difference between
% change of M. persicae from IR beginning and end of experiment between treatment groups

Statistical Analyses

One-way ANOVA
Compare % change of aphid movement during 3 timepoints



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