

Variability in herbivore-induced jasmonate levels across the maize inbred lines from different geographical regions



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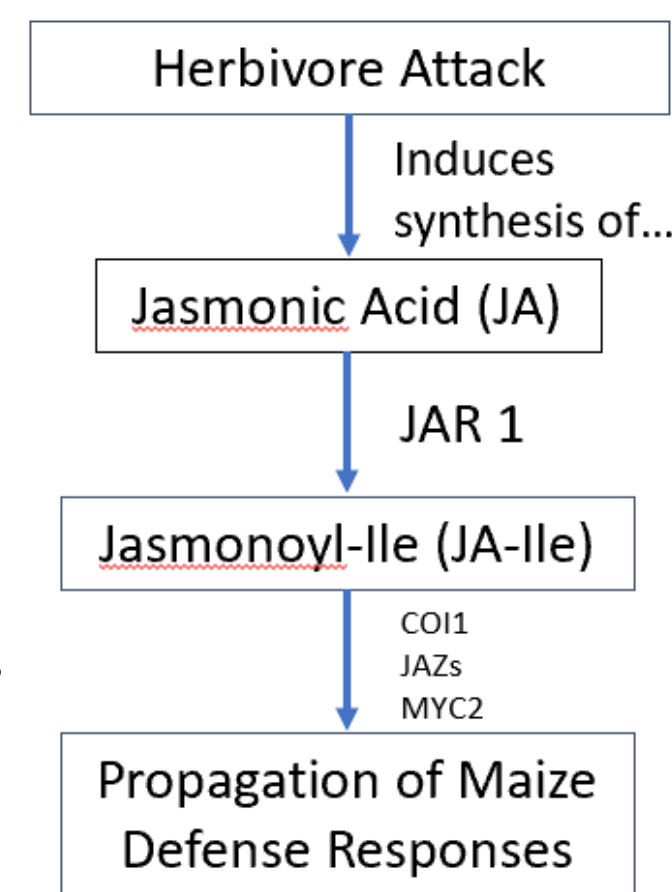


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Background

- There is significant genetic diversity among the maize (*Zea mays*) inbred maize lines. Genetic variation between any two inbred lines is greater than genetic variation between humans and chimpanzees.
- Given the economic importance of maize, understanding its defense responses to biotic stressors is vital

- Jasmonic acid (JA) is a phytohormone known to increase in maize plants after herbivore attack
- JA and Isoleucine are combined by JAR1 to produce JA-Ile, which leads to a series of defense reactions
- Differences in JA levels is indicative of differences in JA-Ile, and therefore differences in plant defenses



Objectives/Hypothesis

Objectives

- Assess the variability in JA and JA-Ile levels in the different maize lines collected from various agroecological conditions
- Assess natural variability in JA-mediated defense metabolite accumulation among the maize inbred lines.

Hypothesis

- Maize inbred lines from different geographical regions exhibit significant differences in the accumulation of herbivore-induced JA, JA-Ile and defense metabolites.

Methodology

Growth Rate Experiment:

- Grow 12 maize inbred lines (n=21) in the greenhouse for 3 weeks
- Compare the growth rate of the inbred lines by measuring the height of the plants (from the crown to the whorl)
- Importance
 - When plants highly defensive – growth rate typically slower
 - When plants less defensive – growth rate typically faster

Caterpillar Performance

- Grow 12 maize inbred lines (n=21) in the greenhouse for 3 weeks
- Weigh 5d-old *S. exigua* neonates and place them onto individual plants of each inbred line
- Place the plants and the caterpillars into perforated breadbag and allow caterpillars to feed freely for 5 days
- Weigh the caterpillar on day 5

Spit Induction/Jasmonic Acid Extraction

- Grow wildtype maize B73 inbred line in the greenhouse for 3 weeks
- Place neonates (5d) of *S. exigua* on the plants and allow them to feed for 5d.
- Collect oral secretions from the caterpillars by applying gentle suction pressure on the mandibles of the caterpillars
- Dilute the oral secretion 50x (in water; v/v) before use

Results

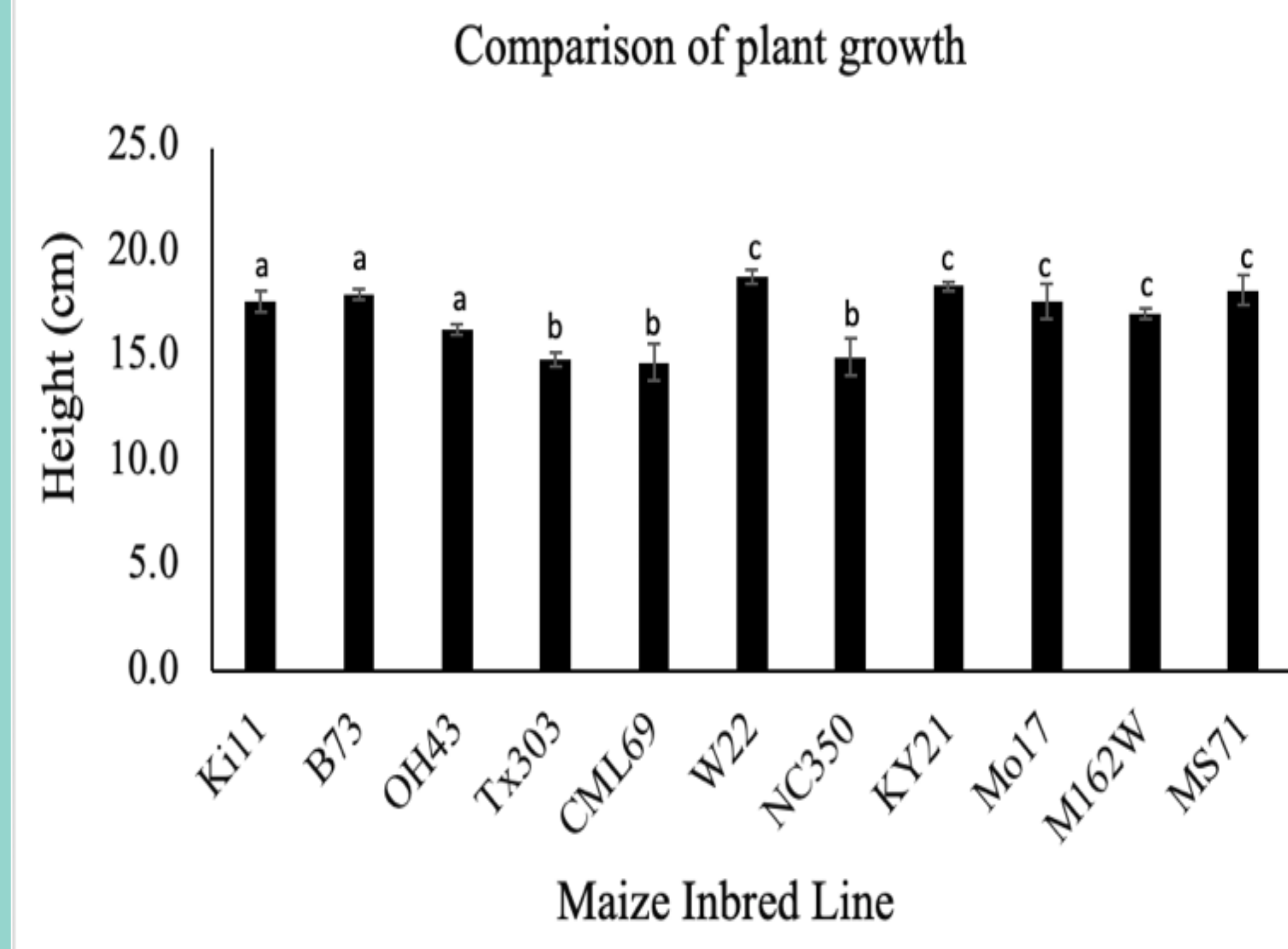


Figure 1. Average height (cm) of the maize inbred lines .

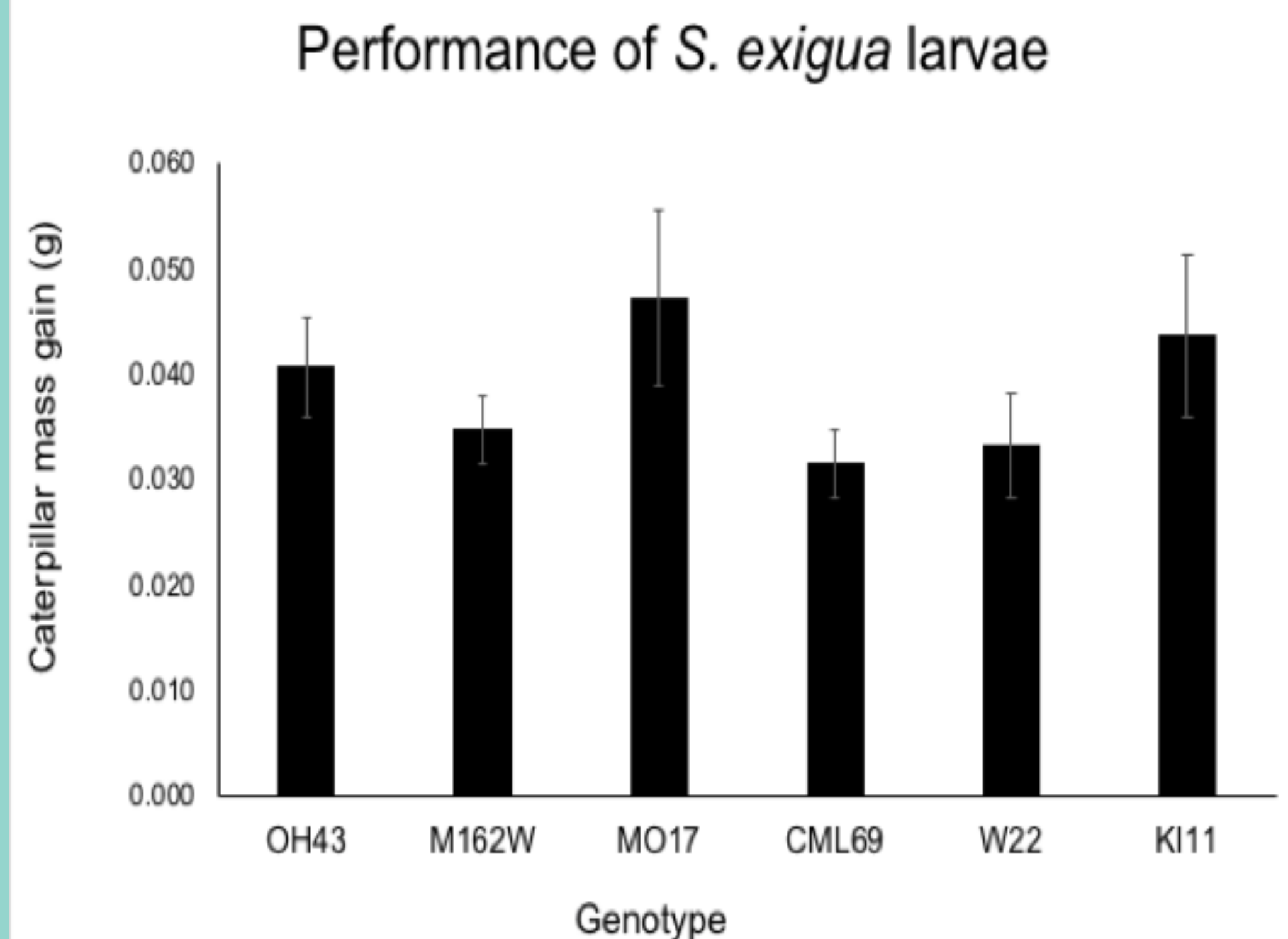


Figure 2. Mean caterpillar (*S. exigua*) performance for each genotype. OH43: N=14, M162W: N=15, MO17: N=15, CML69: N=17, W22: N=15, KI11: N=14

Conclusion/Future Direction

Growth Rate Experiment

- No significant difference in plant growth between all maize inbred lines
- Three distinct groups significantly different from each other but can likely be attributed to small sample size
- Bringing all these lines together in the same greenhouse environment that are normally used to growing in drastically different environments – could also account for these differences

Caterpillar Performance

- There is no statistically significant difference between the genotypes in the terms of caterpillar mass gain
- what does that mean?
 - 1) there isn't any difference in the defense levels or
 - 2) there is a difference, but we are using specialist caterpillars and these caterpillars are not affected by small differences in defense metabolites
- Next step: do an experiment in which we use a generalist herbivore

Spit Induction/Jasmonic Acid Extraction

- Still waiting on spectrometry results

As a scientist, we need to ask ourselves:

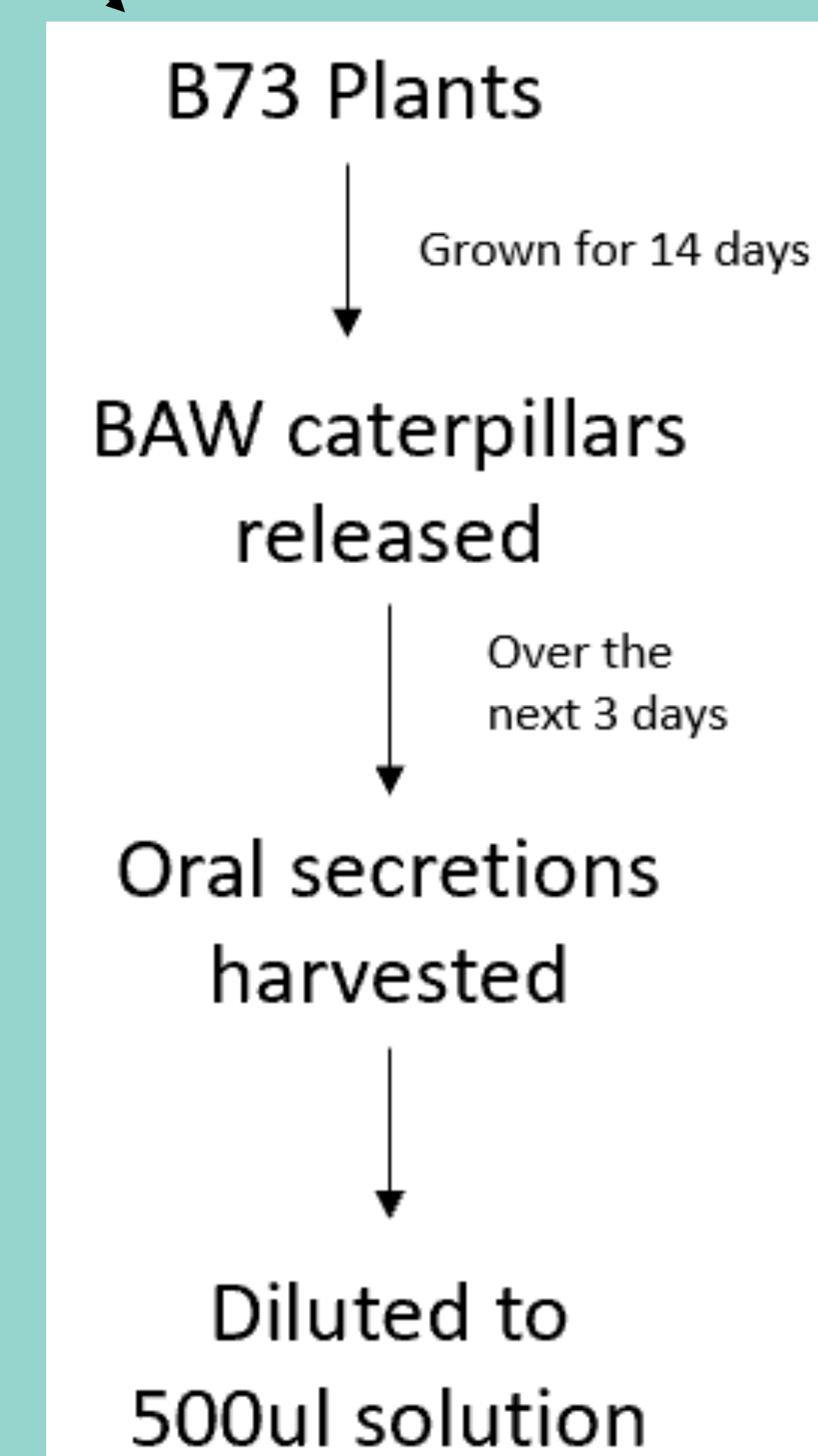
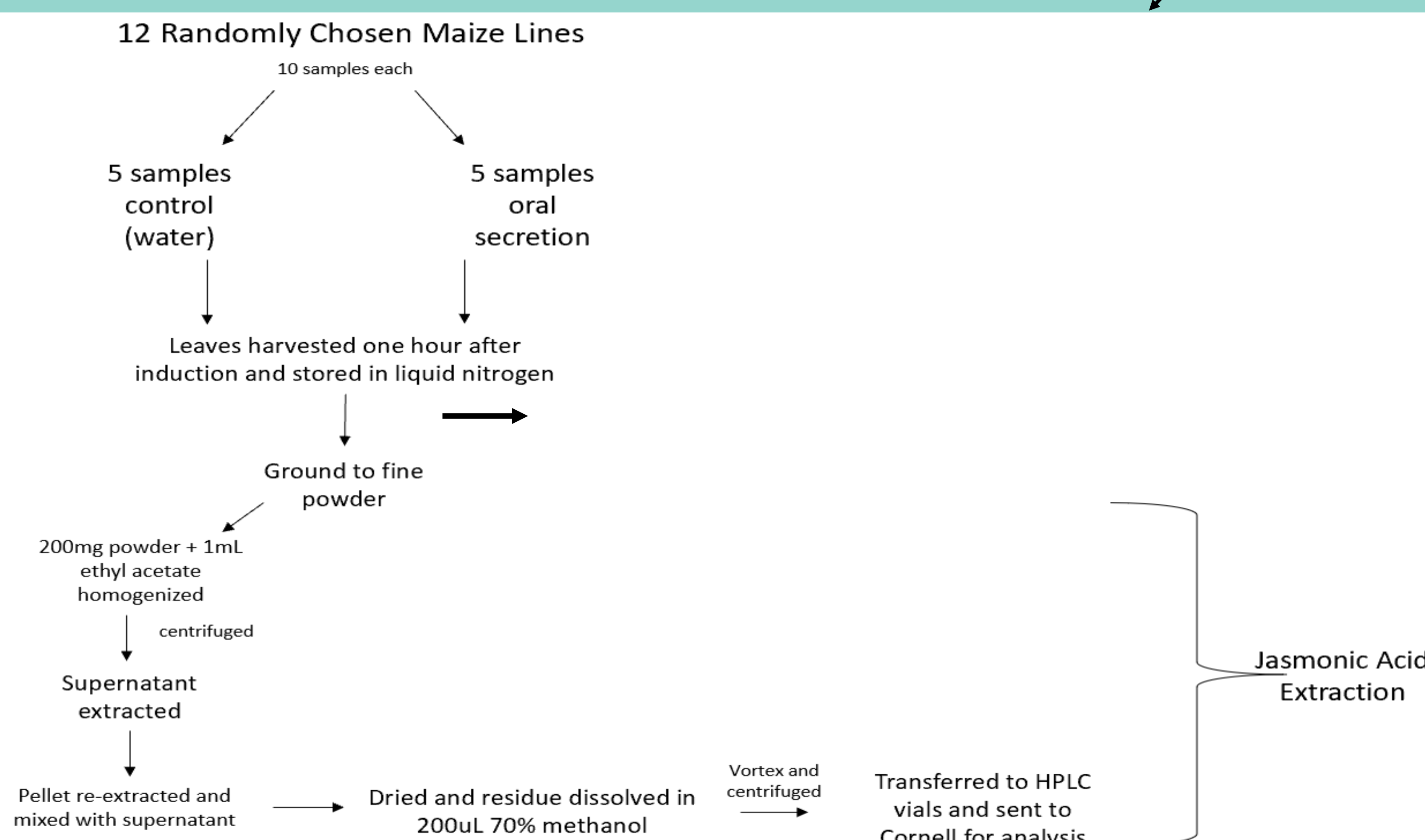
- If there are difference in defense metabolite levels, which metabolites are different exactly?
- What are the biological differences?
- How do each component of these metabolites affect the caterpillars?

Eventually, understanding the answer to each of these questions may lead to the discovery of a natural insecticide that can be used on maize.

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Jasmonic Acid Extraction