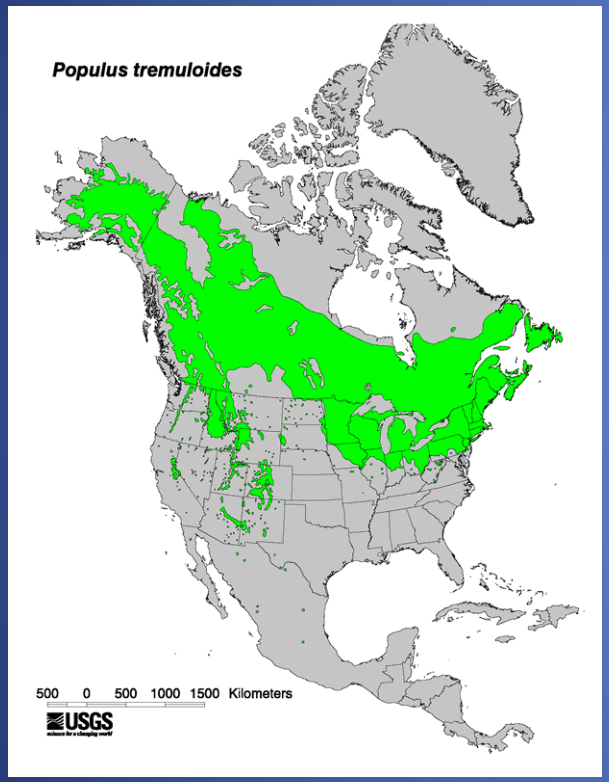
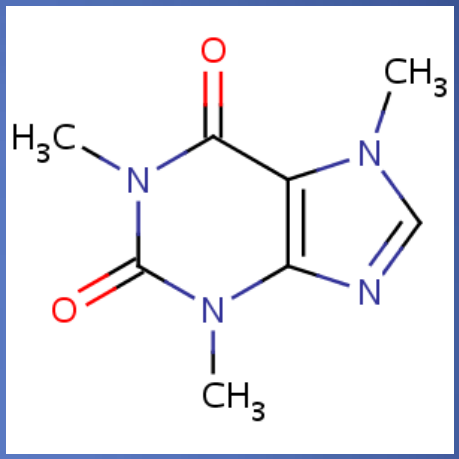
Causes and consequences of variation in extrafloral nectar secretion by quaking aspen (Populus tremuloides Michx)

Jonny Newman
and
Diane Wagner
University of Alaska Fairbanks
Biology and Wildlife Department

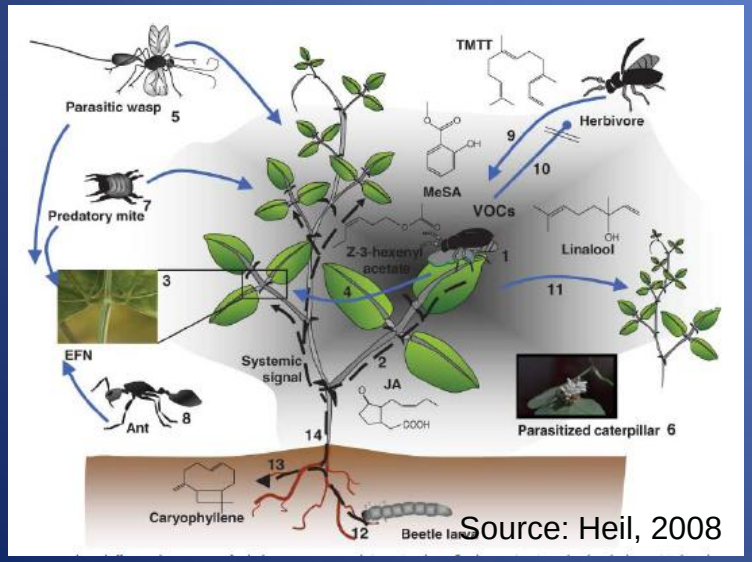
Quaking aspen



Plant defenses: direct



Plant defenses: indirect



Aspen EFNs


Photo: D. Wagner


Photo: D. Wagner

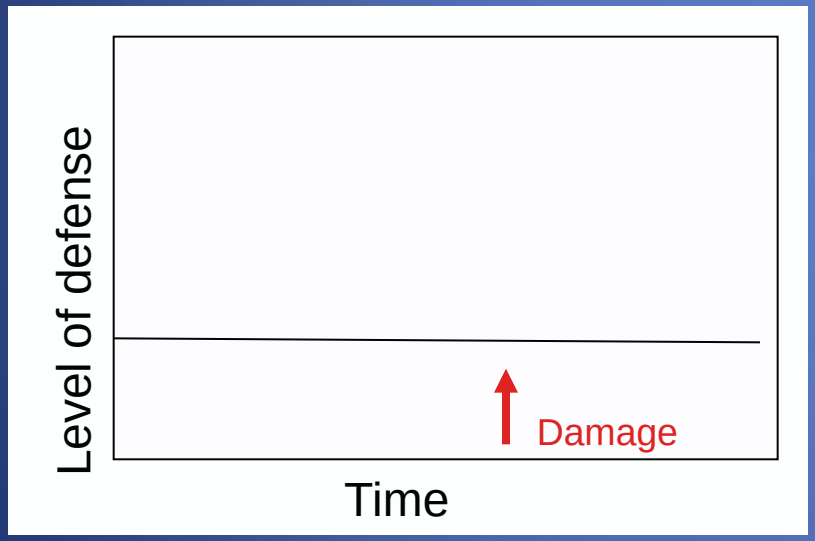
Predators

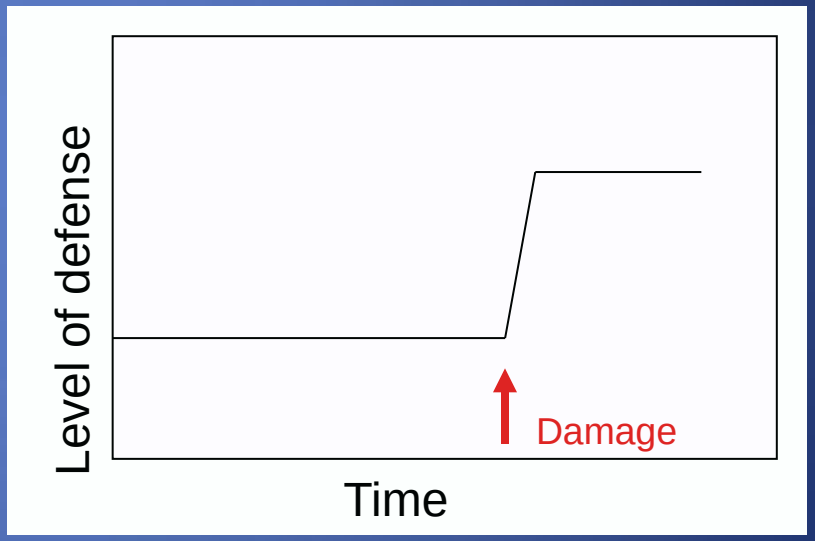

Photo: P. Doak


Photo: D. Wagner

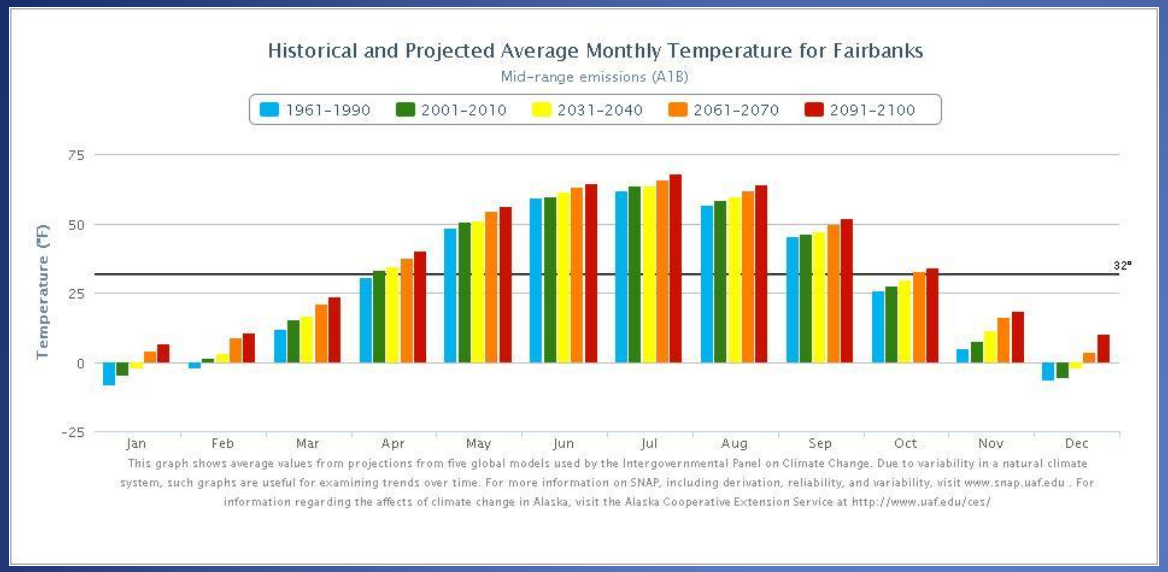

Photo: D.Wagner

Plant defenses: constitutive and inducible

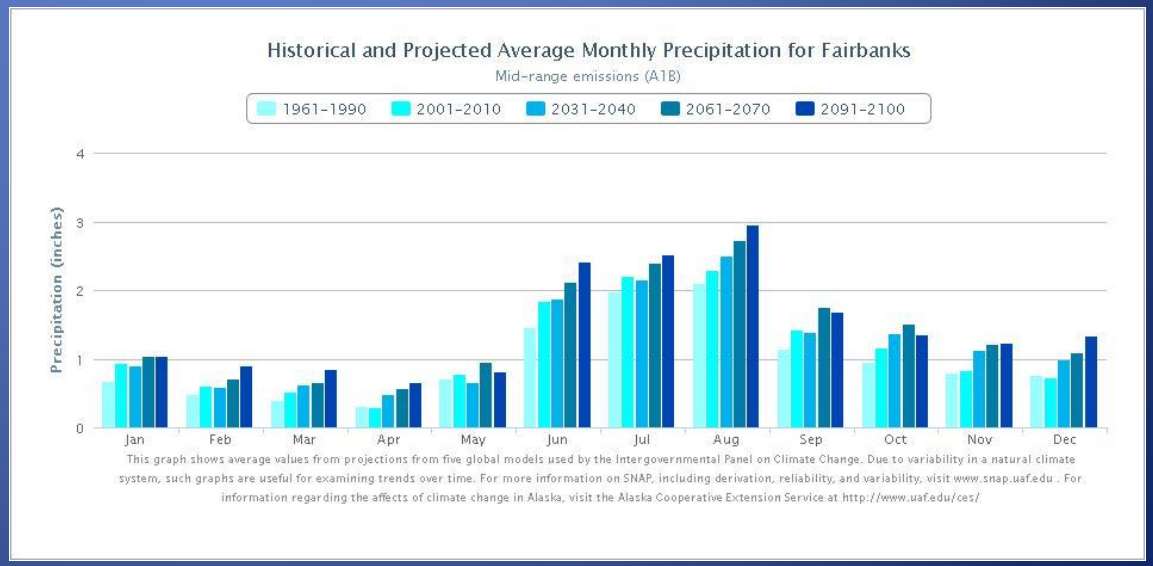




Climate change and drought stress



Scenarios Network for Alaska Planning

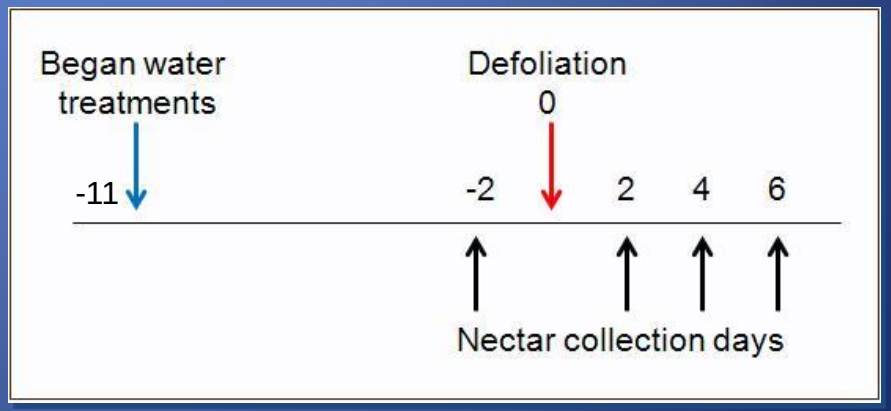


Objectives

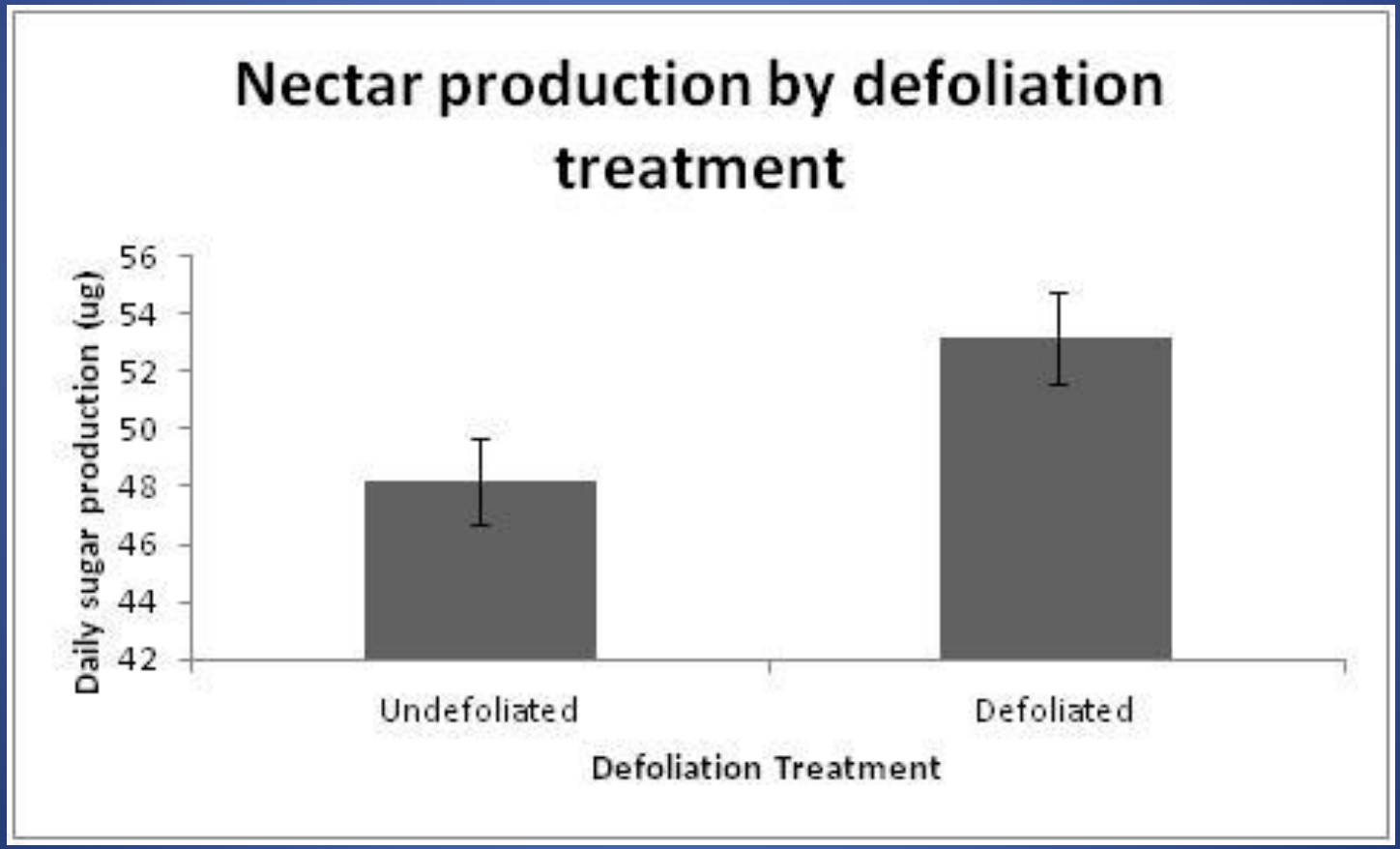
- Determine if aspen extrafloral nectar secretion is inducible by herbivory.
- Measure impact of drought stress on induction response (if present).
- Measure impact of EF nectar availability on ant foraging behavior.

Inducibility of EF nectar: methods

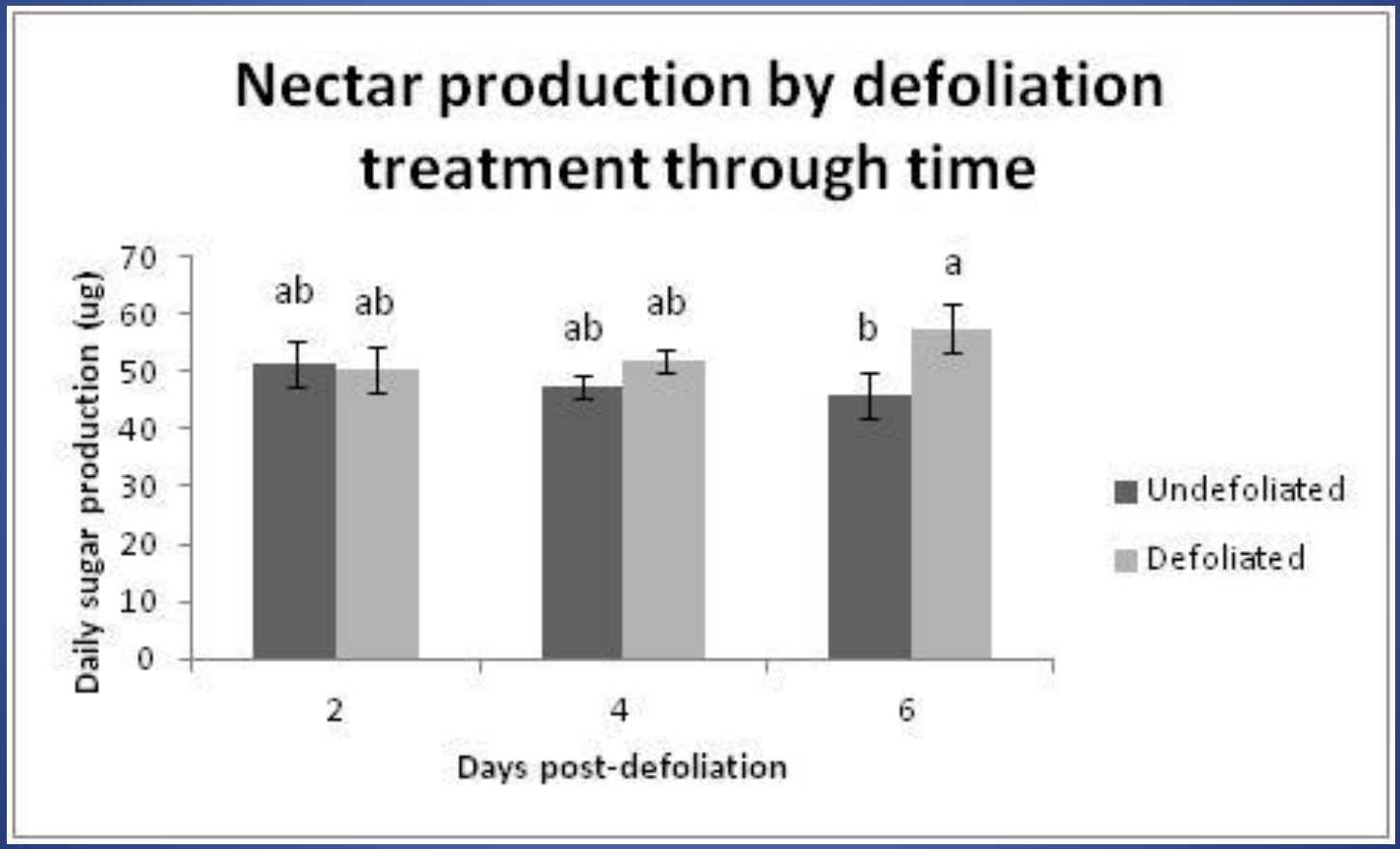
- 2x2 factorial:
  - Drought and well-watered (control)
  - Defoliated (50% leaf area reduction) and undefoliated
- Plants from four distinct genotypes
- Collected sugar secretions every 48h



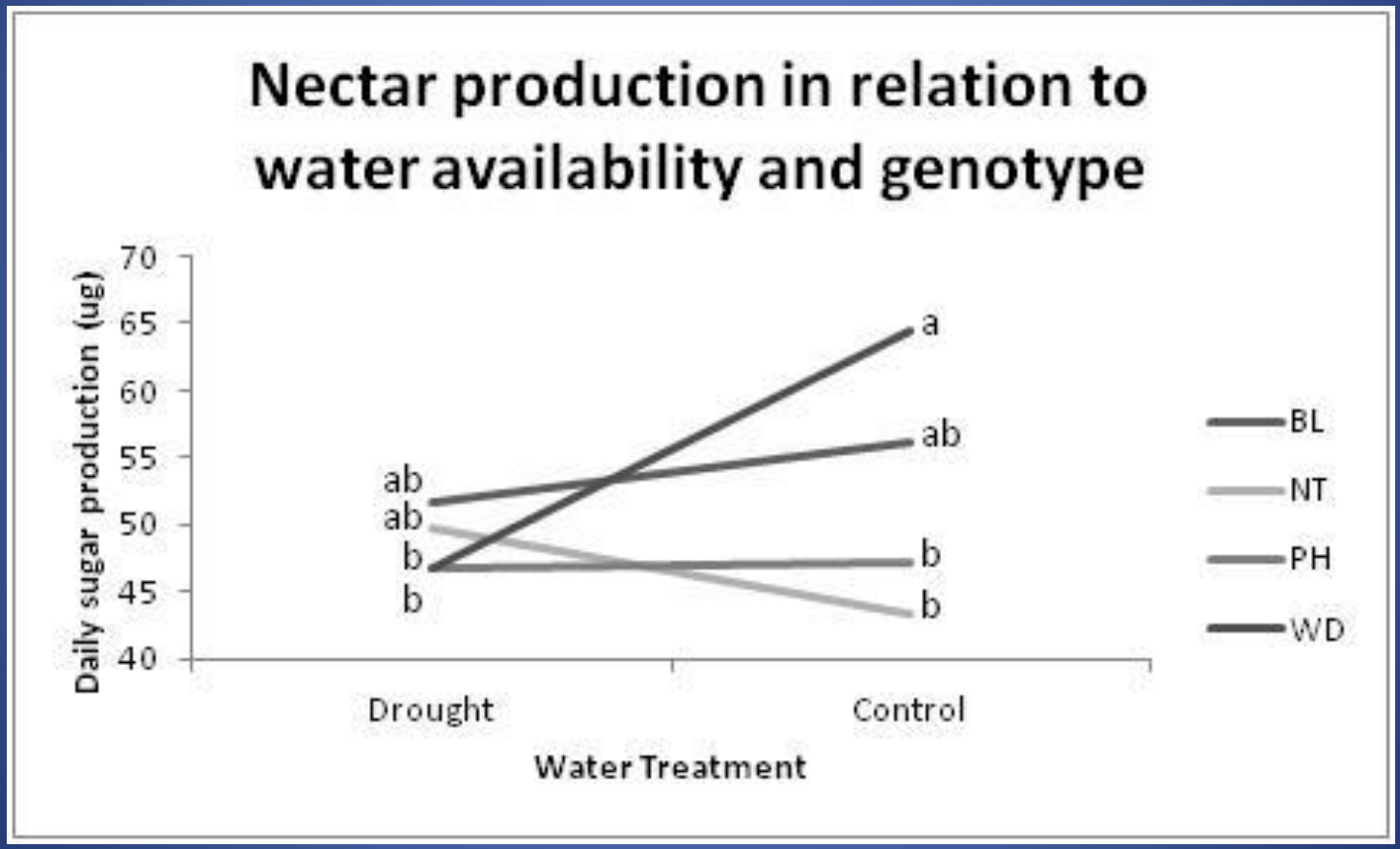
Results


Nectar production by defoliation treatment
Daily sugar production (ug)
56
54
52
50
48
46
44
42
Undefoliated
Defoliated
Defoliation Treatment

Results

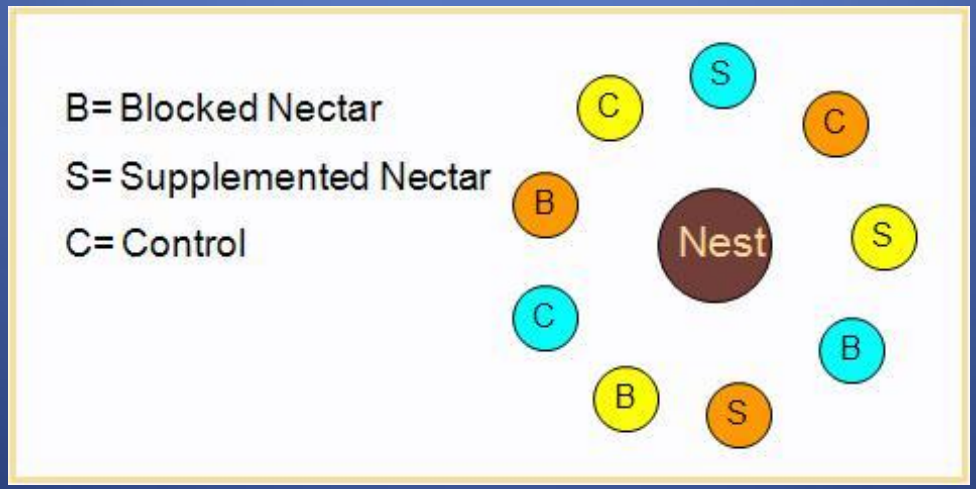

Nectar production by defoliation treatment through time
Daily sugar production (ug)
70
60
50
40
30
20
10
0
ab
ab
ab
ab
b
a
2
4
6
Days post-defoliation
Undefoliated
Defoliated

Results

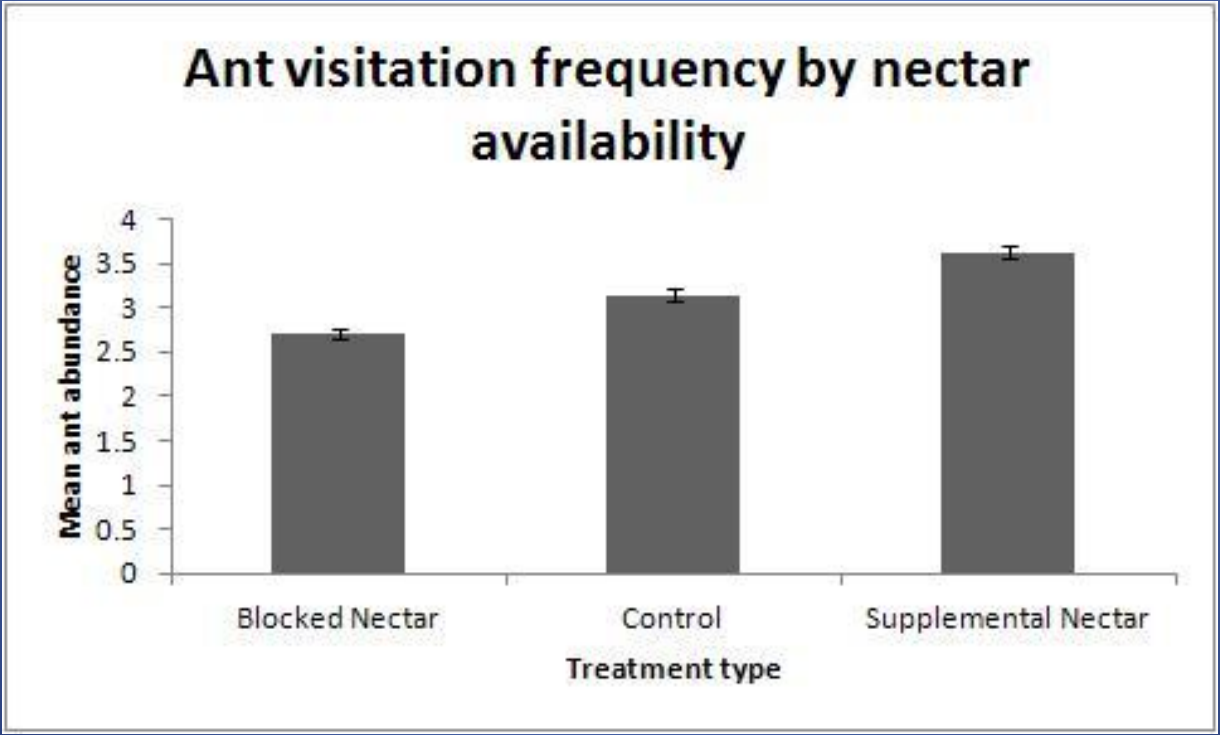

Nectar production in relation to water availability and genotype
Daily sugar production (ug)
70
65
60
55
50
45
40
a
ab
ab
ab
b
b
b
b
Drought
Control
Water Treatment
BL
NT
PH
WD

Effects of nectar on ant foraging behavior: Methods

- Manipulated amount of nectar available:
  - 3 treatments: blocked, supplemented, control
  - Treatments were applied to aspen from 3 clones
  - Plants were placed surrounding 6 ant nests
- Performed repeated censuses of ant abundance



Results


Ant visitation frequency by nectar availability
Mean ant abundance
4
3.5
3
2.5
2
1.5
1
0.5
0
Blocked Nectar
Control
Supplemental Nectar
Treatment type

Conclusions

- Rate of sugar secretion by aspen extrafloral nectaries is inducible by herbivory
  - Relatively rapid time scale
  - Induction is not inhibited by drought
- Effects of drought stress on nectar secretions may vary between clonal stands
- Nectar induction likely leads to increased visitation by ant predators