



# EARTHWORMS AND THE WEED SEED BANK

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# Why are Earthworms Important?

- Shaping Soil Dynamics
  - ▣ Casts
  - ▣ Burrows
  - ▣ Soil Nutrient Content
- Shaping Plant Community Dynamics
  - ▣ Root Growth (Arnone & Zaller 2014, Scheu 2003)
  - ▣ Seed Bank?

Ultimately, we need more information . . .

# Why are Earthworms Important?



**Do earthworms have an effect on the seed bank of weeds commonly found in Palouse wheat fields?**

# What is a Seed Bank?

- Viable, non-germinated seeds stored in the soil  
(Thompson and Grime 1979)
- “. . . Allows them to bridge temporally unsuitable habitat conditions” (Forey et.al. 2011)

What mechanisms facilitate the development of this seed bank?

# Earthworm/Seed Interactions

- Seeds are thought to be an essential part of earthworm nutrition (Eisenhauer et.al 2010, Forey et.al 2011)
- Predation by earthworms could have many effects on seeds including:
  - ▣ Increased Germination (Eisenhauer et.al 2009)
  - ▣ Decreased Germination (Eisenhauer et.al 2009)
  - ▣ Seed relocation (Forey et.al 2011, Regnier et.al 2008, Zaller et.al 2007)
- The effects are specific to each worm species x weed species

# Species

*Aporrectodea trapezoides*:

Endogeic

Usually less than 7.6-10.2 cm long



○ Horizon (litter layer)

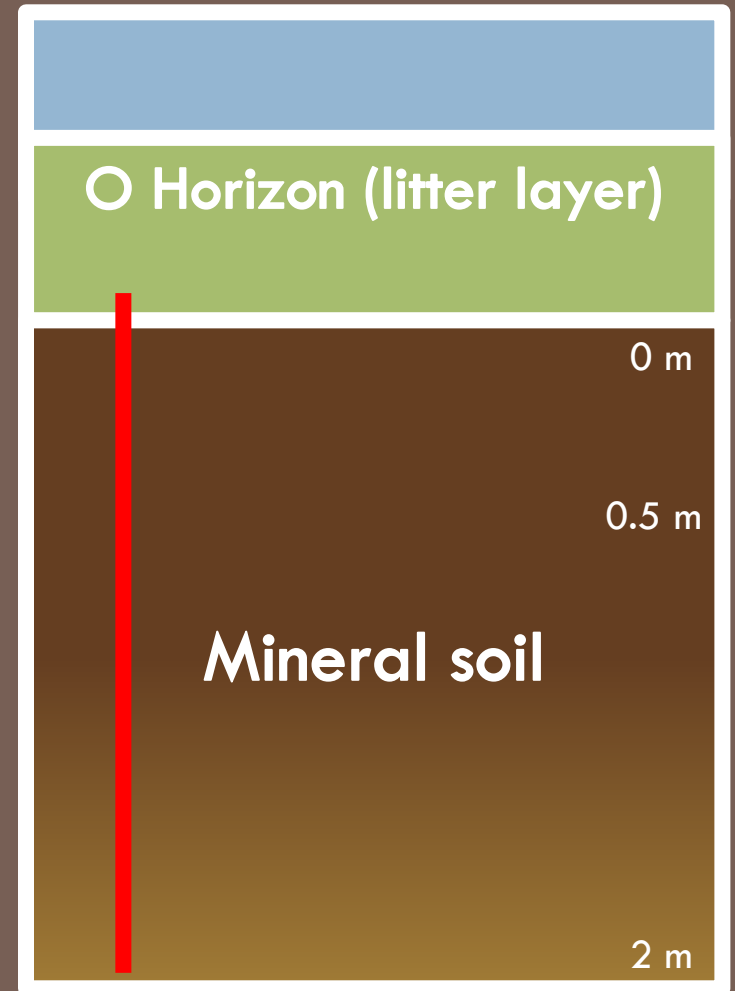


# Species 2

*Lumbricus terrestris*:

Anecic

Up to 30 cm long



# My research

- Part I: What will *A. trapezoides* and *L. terrestris* eat? Does ingestion of seeds affect rates of germination?
- Part II: Do the earthworms move these seeds throughout the seed bank.



# Part I: Methods



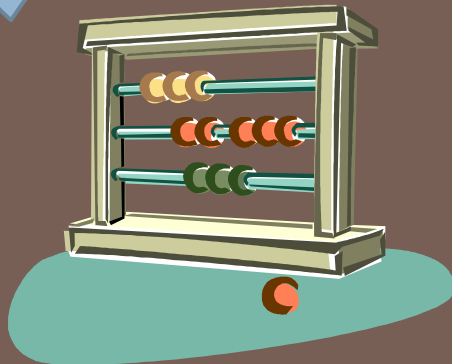
Void Guts, 48 hrs



Void Guts, 48 hrs



Add worm to plate with soil and 20 seeds



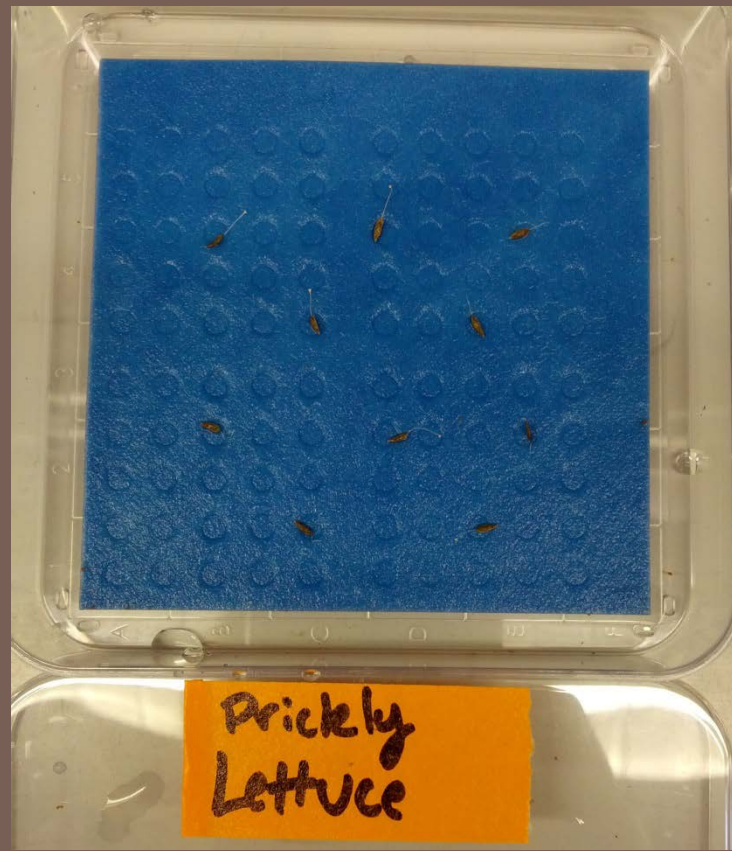
Count remaining seeds.



Incubate 24 hrs



# Part I: Methods



# Part I: Results

## *A. trapezoides*

Species	% of seeds recovered	% seeds egested	% seeds missing
Prickly Lettuce	87.6	7.1	5.7
Bindweed	98.6	0	1.4
Ventenata	100	0	0
Rattail Fescue	98.6	0	1.4

## *L. terrestris*

Species	% of seeds recovered	% seeds egested	% seeds missing
Prickly Lettuce	12.6	13.3	74.1
Bindweed	73.6	15	11.4
Ventenata	100	0	0
Rattail Fescue	91.4	4.3	4.3

*A. trapezoides* prefers smaller seeds while *L. terrestris* will eat both small and larger rounded seeds.

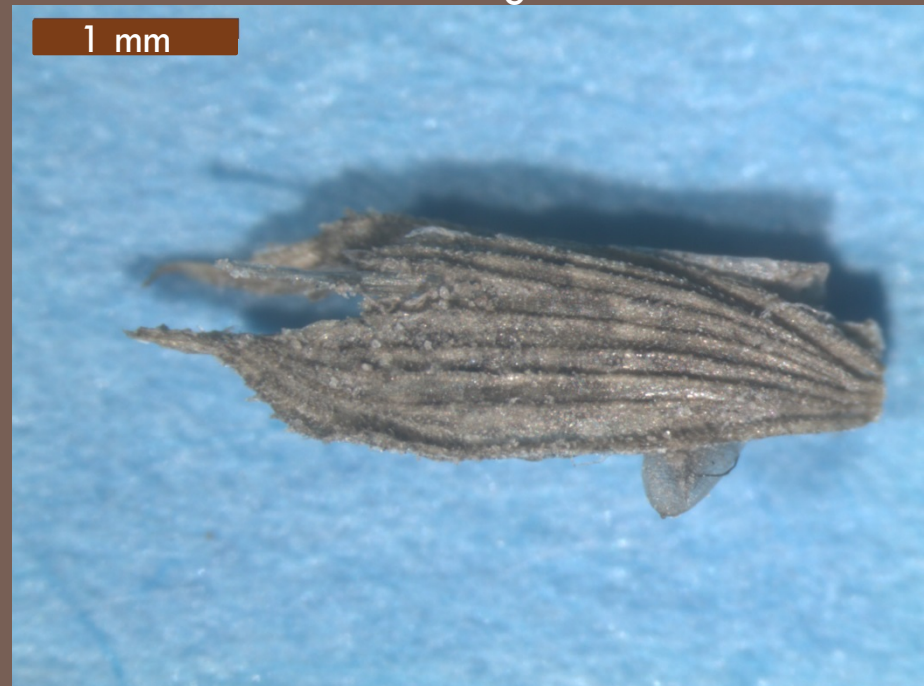
# Part I: Results

## A. *Trapezoides*

### Prickly Lettuce Trial

Plate #	% of seeds eaten	% of eaten seeds germinated
1	55	0
2	35	0
3	45	33
4	55	36
5	30	0
6	10	0
7	75	47
Control	N/A	45.0
Total	43.6	23.0

4.3% of seeds from experiment were determined to be “missing”



Other controls germinated at 60%

# Weed Species

- Redroot Pigweed (*Amaranthus retroflexus*)
- Prickly Lettuce (*Lactuca serriola*)
- Field Bindweed (*Convolvulus arvensis*)





# Part II: Methods

- Into each mesocosm:
  - ▣ Autoclaved Soil, inoculated with 1 gram sieved soil, water added through a wicking system
  - ▣ 3 *L. terrestris*
  - OR** 3 *A. trapezoides*
  - ▣ 100 weed seeds of one species

Soil can then be removed in layers and washed to determine how many seeds were at each depth



# Part II: Methods

## □ 5 treatments

- *A. trapezoides* x Prickly Lettuce
- *A. trapezoides* x Redroot Pigweed
  
- *L. terrestris* x Prickly Lettuce
- *L. terrestris* x Redroot Pigweed
- *L. terrestris* x Field Bindweed



13.5 cm x 13.5 cm x 18 cm

# Part II: Results



*L. terrestris* x Bindweed  
at T=0



*L. terrestris* x Bindweed (#27)  
at T= 1 day



# Part II: Results



## Prickly Lettuce

Mesocosm	% remaining on soil surface
1	64
2	78
3	92
4	87
5	60

# Part II: Results



## Redroot Pigweed

Mesocosm	% remaining on soil surface
1	75
2	65
3	54
4	84
5	51

# Summary

- Seed preference
  - *A. trapezoides* prefers smaller seeds
  - *L. terrestris* consumes small and larger seeds
  - Neither eat grass seeds
- Prickly Lettuce
  - Appears to be commonly preyed upon by earthworms
  - Reduced Germination? Possibly destroyed by gut grinding
- The Effects of Seed Predation on the Seed Bank
  - *L. terrestris* appears to carry bindweed seeds deeper into the soil
  - Surface casts and missing seeds indicate *A. trapezoides* may also bury seeds in the seed bank



# Questions?