Temperature-dependent Influence of Fungi on Seed Mortality Suggests Difference in Seed Bank Persistence of Sahara Mustard between California and Arizona

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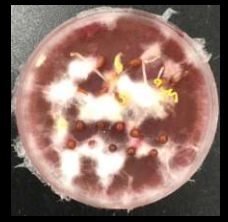

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Sahara mustard (*Brassica tournefortii*) invades the big desert

- A winter annual species native to the Mediterranean and the Middle East
- Has invaded most of the Sonoran and Mojave Desert
- Has reduced diversity of native desert winter annual plants and the arthropod communities associated with them

  Barrows et al. 2009, VanTassel et al. 2013, *Biological Invasions*

A soft spot of the troublesome invader

- Short-lived seed bank in southwestern Arizona
  - High germination rate
  - High mortality of seeds that didn't germinate

    Li & Chesson 2018 *Evolutionary Ecology Research*
- Most degraded seeds are likely consumed by pathogens
- Summer monsoon is absent over its native range
  - Are mustard seeds vulnerable to fungi active in the summer?

Research questions

- What soil-borne fungi may kill Sahara mustard seeds?
- Are they only targeting Sahara mustard seeds?
- Under what conditions (summer vs. winter) will fungi kill the seeds?

Methods: *1. A hunt for the fungi*

- Collect Sahara mustard seeds in Tucson soil
- Surface sterilize seeds
- Separate viable and degraded seeds
- Mash each pool and make a series of dilutions
- Isolate fungi from these dilutions

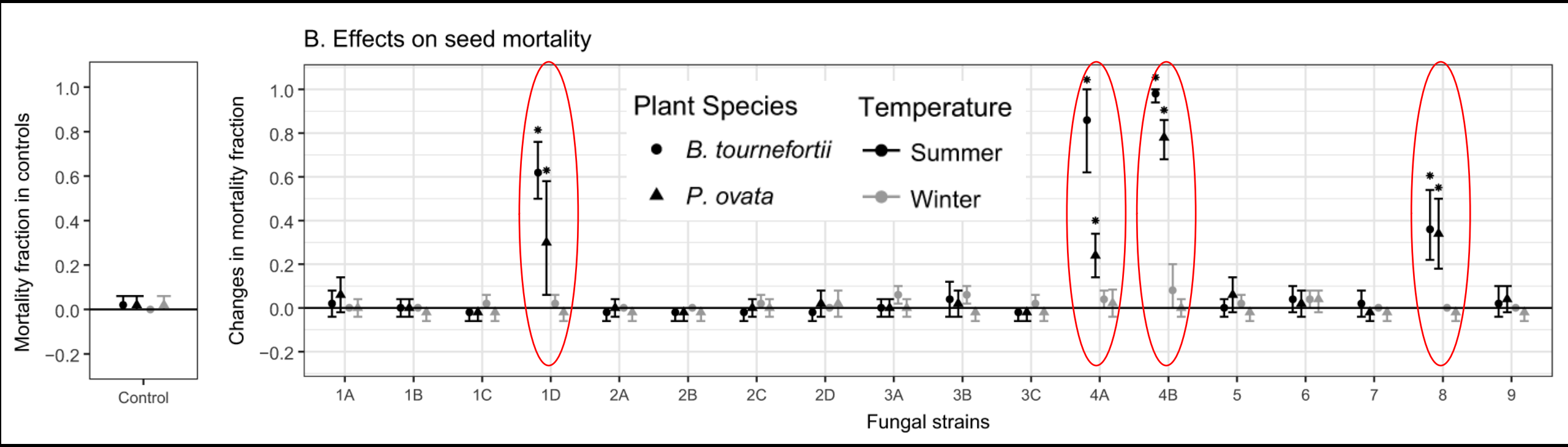
Methods: *2. Knowing the fungi*

- Group them into 43 strains
- DNA sequencing
  (ITS rDNA – partial LSU rDNA)
- All 43 strains are genetically different, belong to 7 orders

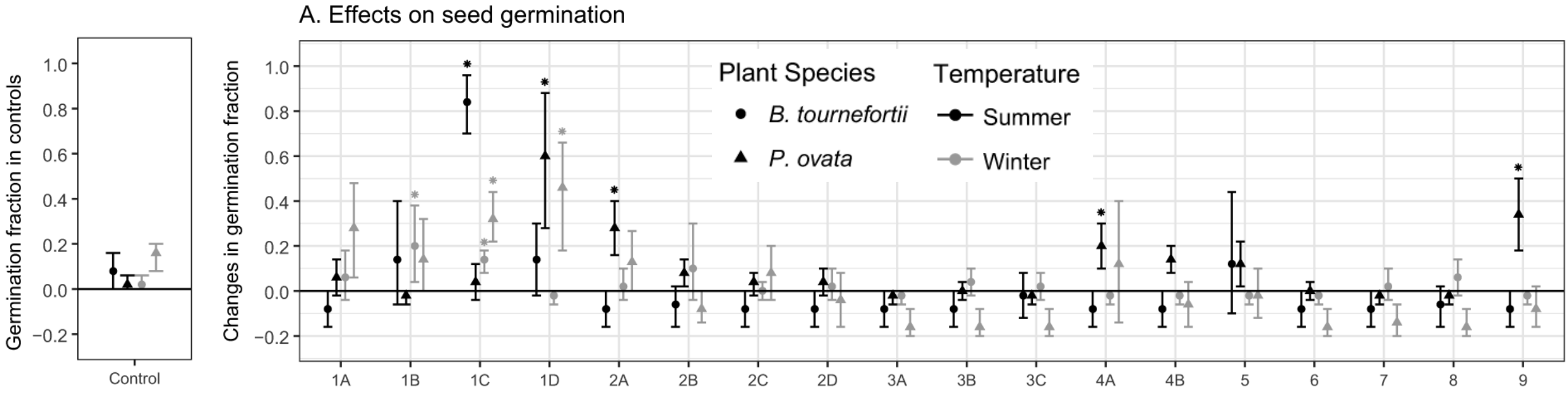
Methods: *3. Letting the fungi loose on seeds*

- Grow 18 strains in Petri dishes
- Inoculate seeds of Sahara mustard and *Plantago ovata*
- Two temperature regimes
  - Summer: 25°C - 37°C
  - Winter: 10°C - 21°C
- 5 replicates of each treatment
- Wait for 13-16 days
- Check seeds under microscopes

Fungi kill seeds only in the summer temperature

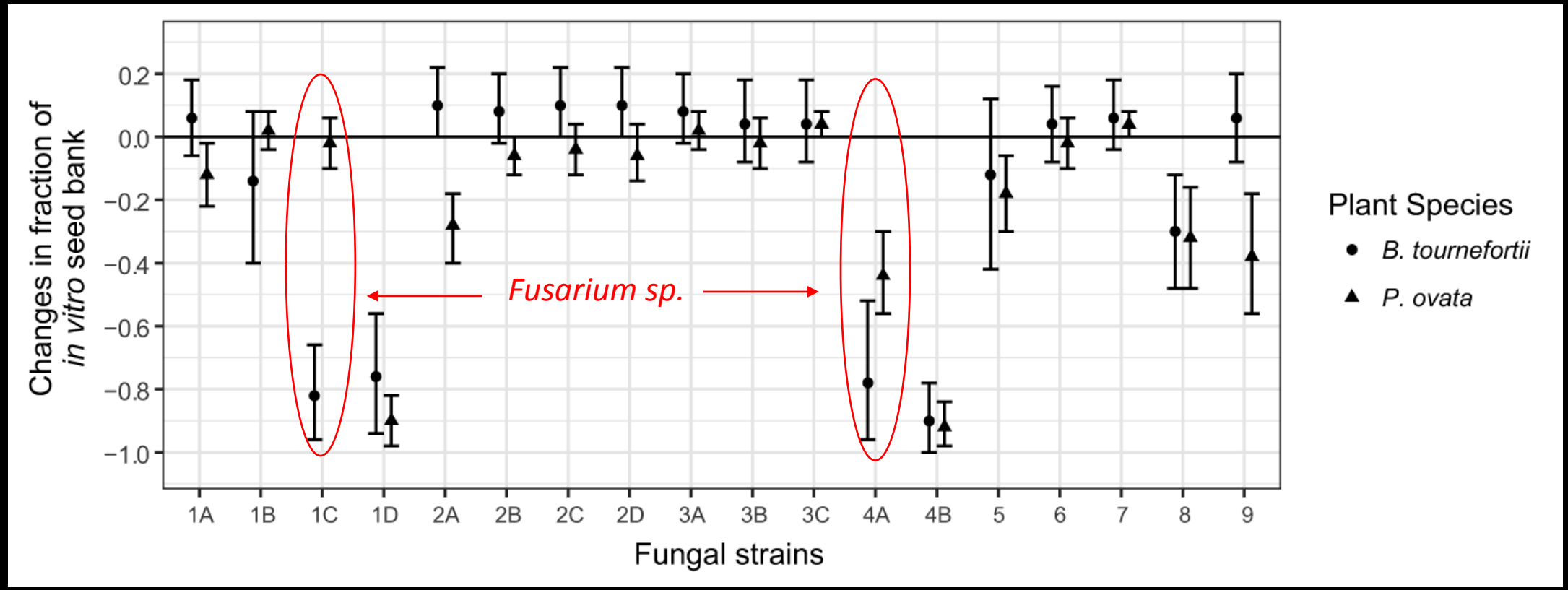


Fungi affect summer and winter germination



Reduction of seed bank can be plant host-specific

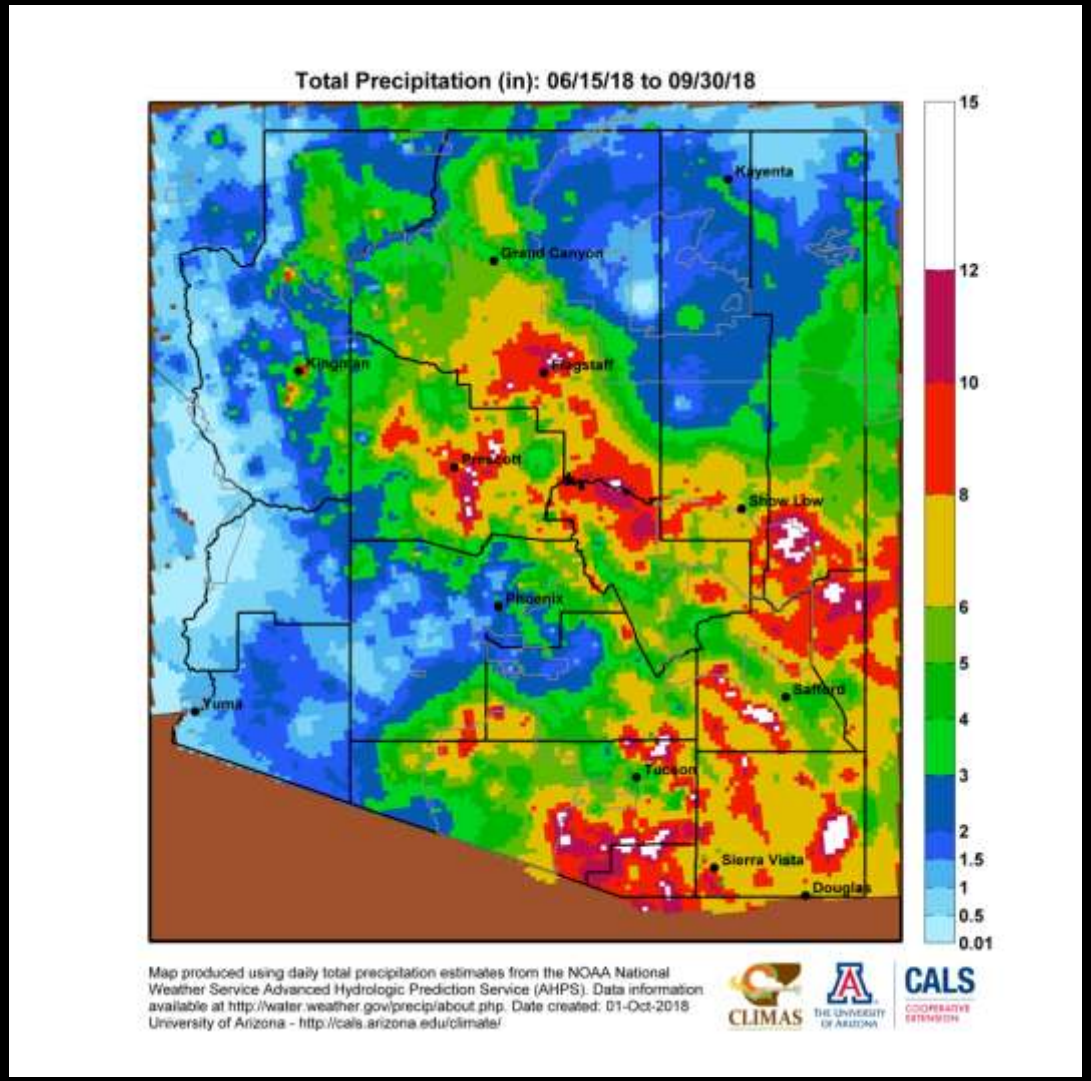
Seed bank loss = seed mortality + summer germination



Implications

Seed mortality occurs only in summer temperatures

- Summer rainfalls may be important for depleting Sahara mustard seed banks
- Regions with less summer rain (e.g. southern California) may host stronger seed banks of Sahara mustard



Implications

- Some fungi may target Sahara mustard seeds specifically, and can be candidates for biological control
  - *Fusarium sp.*

- Others may affect seeds of Sahara mustard and native species evenly
  - *Talaromyces sp.*

Questions?

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