

Phosphorus deficiency and its effects on spatial segregation of the sexes of *Distichlis spicata*.

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# Sexual Dimorphism

- Systematic differences between males and females within the same species
- Common in plant and animal taxa
- Most well-known intraspecific phenotypic variation



# Biased sex ratios of angiosperms

- Many dioecious plant species are separated by sex within a population
- Female-biased sex ratios appear in less stressful microhabitats
- More stressful microhabitats show male-biased sex ratios.

# Spatial segregation of the sexes

- The phenomenon of organisms being separated by sex is termed as “Spatial segregation of the sexes” (SSS)
- Documented in over 25 plant species from 18 different families

# Possible effects of SSS

- Increased distance between individuals could decrease mating success for both sexes
- If sexes have different resource needs, average productivity will increase with SSS
- Inter-sexual competition between the sexes (niche partitioning) might influence SSS

# Pre-reproductive difficulties

- Pre-reproductive plants are usually morphologically indistinguishable
- Little is known about differences in juvenile physiology in most plants
- In most organisms, major stages of development, mortality, and most natural selection occur in juveniles.

# Molecular markers

- By analyzing the DNA of juveniles, we can differentiate between the sexes that otherwise are morphologically identical
- In 1998, Dr. Eppley's lab developed a marker that distinguishes juvenile *Distichlis spicata* males from females

# *Distichlis spicata*

- Exhibits extreme ecological niche sexual dimorphism
- Male and female juveniles exhibit environment specific differences in survival and competitive effects

# *Distichlis spicata*



Male *D. spicata*

Anthers



Female *D. spicata*

Stigma

# PSU stock of *D. spicata*

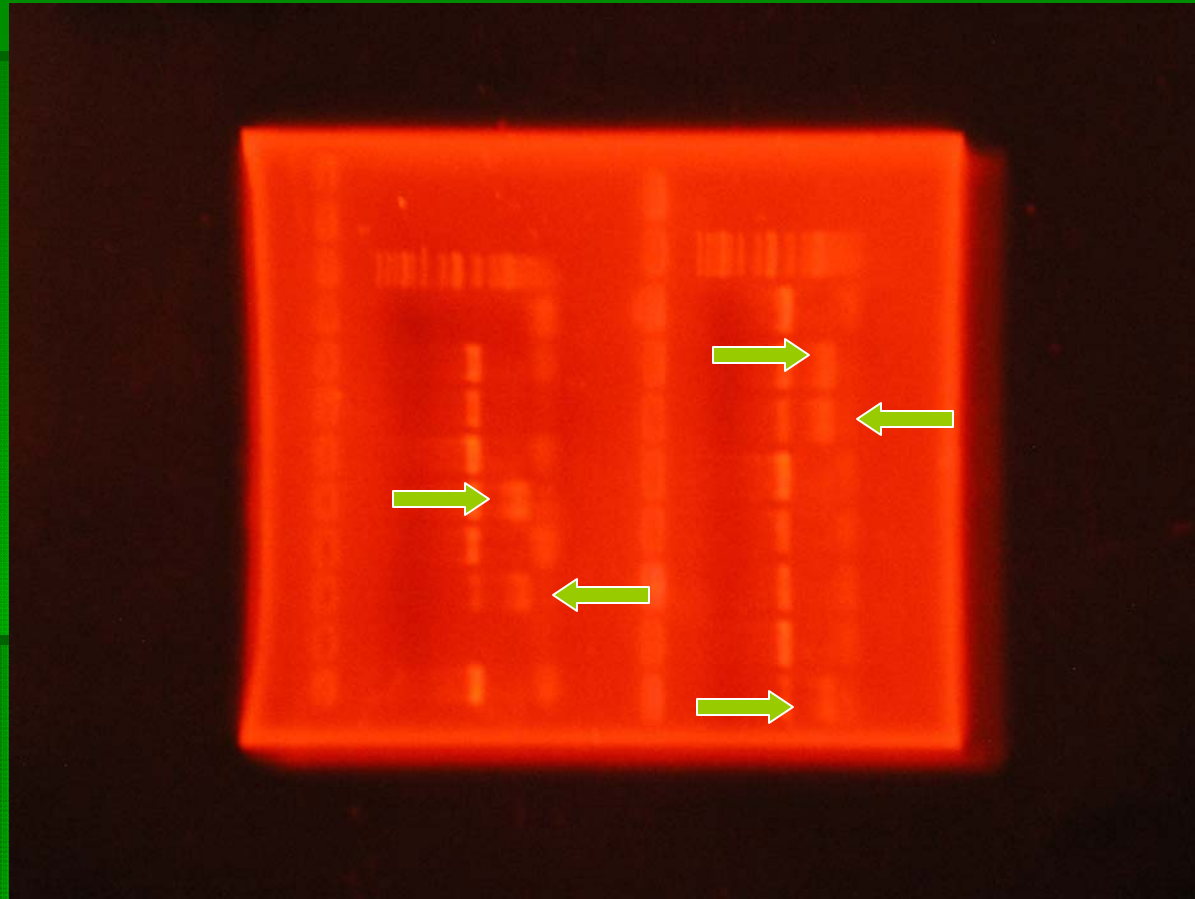
- Grown vegetatively and maintained at Portland State University Research Greenhouse
- Plants grown from seed collected from Pt. Reyes Research Site, north of San Francisco CA, in 2004



# Sexing of juveniles

- *Distichlis spicata* ALB primer and control primer 3 were used to determine the sex of individual plants
- 140 total, 70 males and 70 females, were used to obtain rhizomes to make individual clones

# Gel electrophoresis



317 base pair bands formed by female genotype are highlighted using green arrow. All samples lacking the band are males

# Planting of rhizomes

- Cone-tainers filled with 2 parts Sunshine Mix to 1 part sand
- Each rhizome was weighed and planted with themselves, with a male competitor, and a female competitor

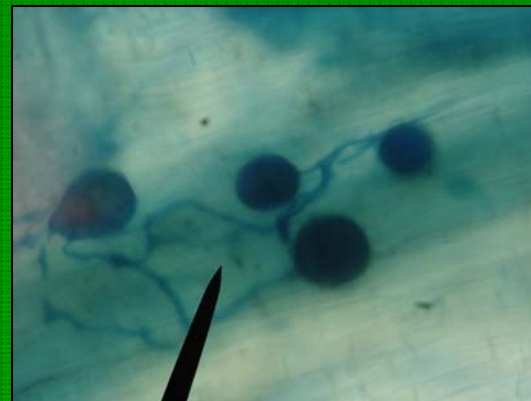


# Treatments

- Each individual under all three competition treatments was grown under four different treatments:
  - with and without mycorrhizae inoculation
  - high and low phosphorus.
- Trays also filled with nitrogen and potassium fertilizers

# Mycorrhizae

- Greek for “Fungus Root”
- Colonizes in the roots of most angiosperms
- Slurry used for inoculation created using dried dirt from the Sand Lake Estuary



# Data Collection

- Plants height will be measured throughout the experiment
- Chlorophyll and fluorescence will be measured once plants were large enough
- At time of harvest, root samples will be collected to analyze mycorrhizae colonization
- Above and below ground weights will also be taken

# Possible conclusions

- Unfortunately, we are currently in the planting stage of this experiment
- From pilot greenhouse studies, it was observed that if a plant had a female neighbor, it would be relatively smaller than if it had a male neighbor
- My prediction is the females, with a male neighbor, mycorrhizal colonization, and high P will be largest

# Significance of research

- Dioecy occurs in over 14,000 angiosperms and many important crops:
  - asparagus, spinach, pistachios, yam, and papaya
- No previous rigorous tests comparing inter-sexual vs. intra-sexual competition have been conducted

# Significance of research

- Understanding the selective forces responsible for extreme sex ratio variation within populations is crucial
- Enable us to advance our understanding of the evolution of dimorphic plant systems

# Acknowledgements

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# Questions

