

Update on Thousand Cankers Disease (TCD or 1KC)

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thousandcankersdisease.info



TCD is Lethal to Black Walnut

Juglans nigra



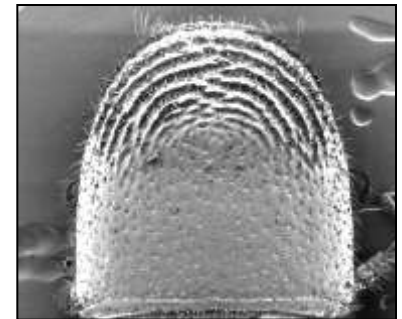
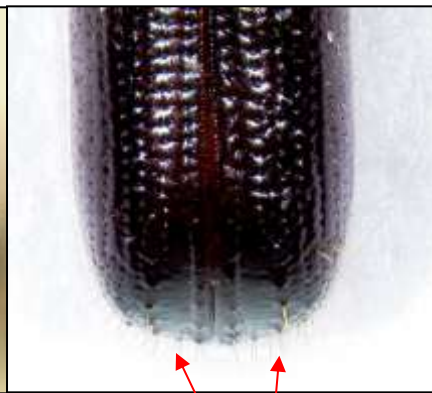
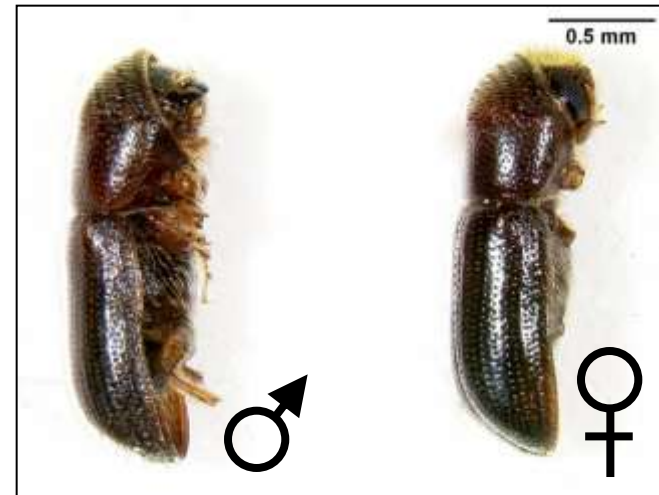
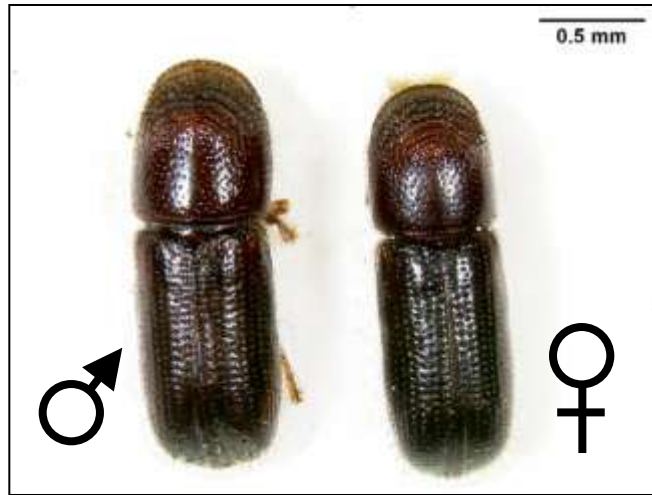
Identification of Walnut Twig Beetle, *Pityophthorus juglandis* Blackman

(Coleoptera: Scolytidae)

An “Über” Vector of TCD

OCD: Almost compulsive boring and tasting behavior on host branches

Slide courtesy
S. Seybold



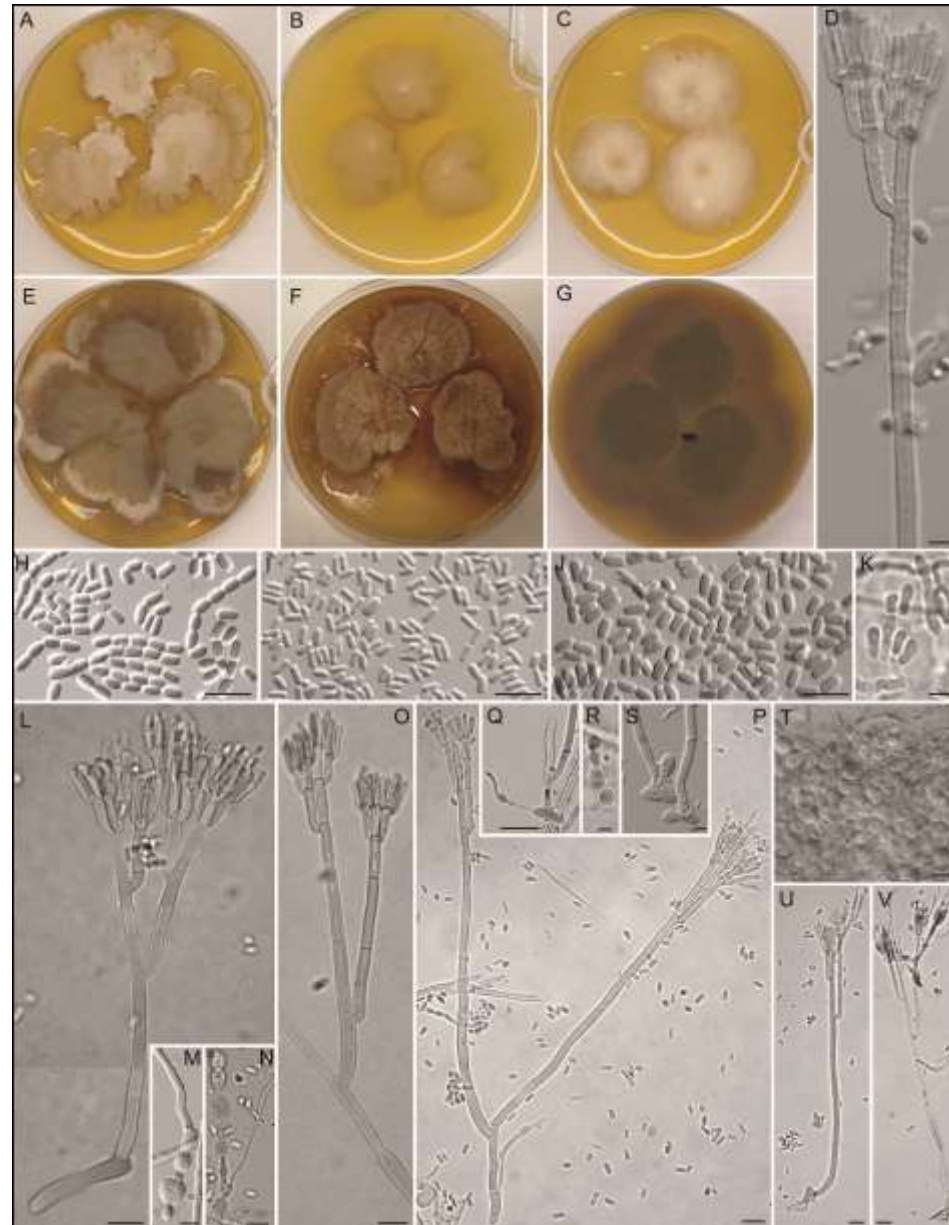
Walnut Twig Beetle

- Meandering galleries in phloem
- **No scoring of wood as with bark beetles**
- Note discoloration surrounding galleries caused by the fungus *Geosmithia morbida*



Geosmithia morbida

- Anamorphic genus
 - (Ascomycota:Hypocreales)
 - No sexual state known
- Off-white to buff in culture, often lobed colony
- Dry conidia
 - Barrel-shaped
 - Unlike Ophiostomatoid and ambrosia fungi (e.g. in *Raffaelea* in Laurel wilt)
- Has a yeast phase
- Thermotolerant
 - Optimal 25-32 °C
 - Will grow at 37 °C (99 °F)
 - Will survive 42 °C (107 °F)



TCD results in pockets of dead phloem – gives bark a marbled appearance



Outer bark
Phloem
Wood



Cankers eventually will kill the cambium and discolor sapwood

- *Geosmithia morbida* often produces copious # spores in canker/galleries
- As far as we know, the conidia are not important in aerial dissemination
 - Fungivores (*Cryptolestes* sp.) often contaminated





June 2008

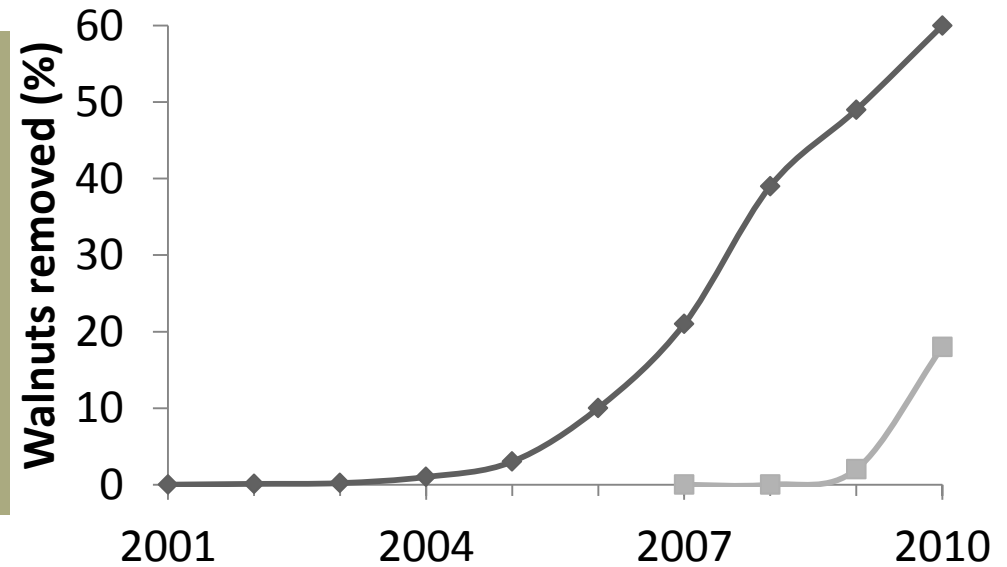
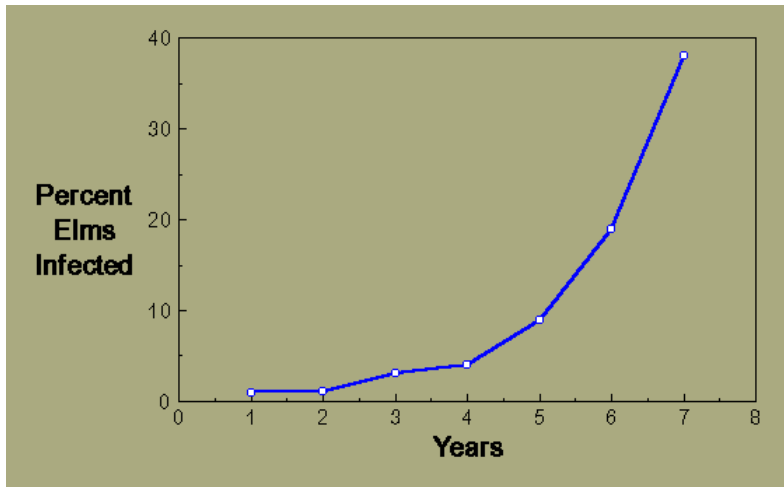


September 2008



June 2009

Comparison of Epidemics of Dutch Elm Disease (historical) to TCD in Boulder and Denver



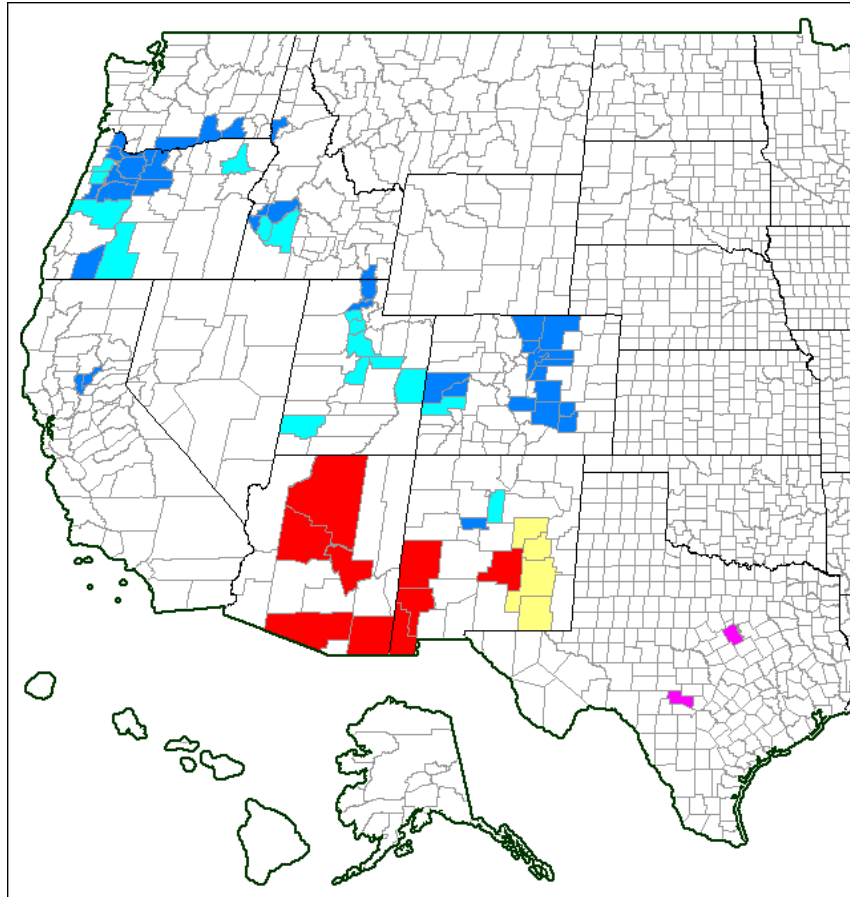
Most of the remaining trees in Boulder are less than 10 inches DBH





TCD is not limited to Colorado

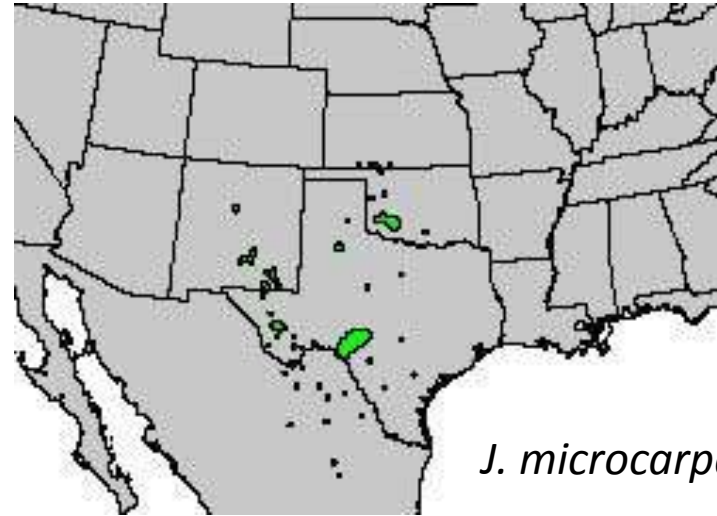
- Probably started in Utah and Oregon in late 80's to early 90's
- New locations in West being recorded
 - Walla Walla Washington 2009
 - Parma Idaho 2010



Distribution of TCD in the West



-  = positive *J. nigra*
-  = positive *J. major*
-  = negative *J. major*
-  = negative *J. microcarpa*



J. microcarpa



J. major

Good Grief!

TCD found in Tennessee July 2010

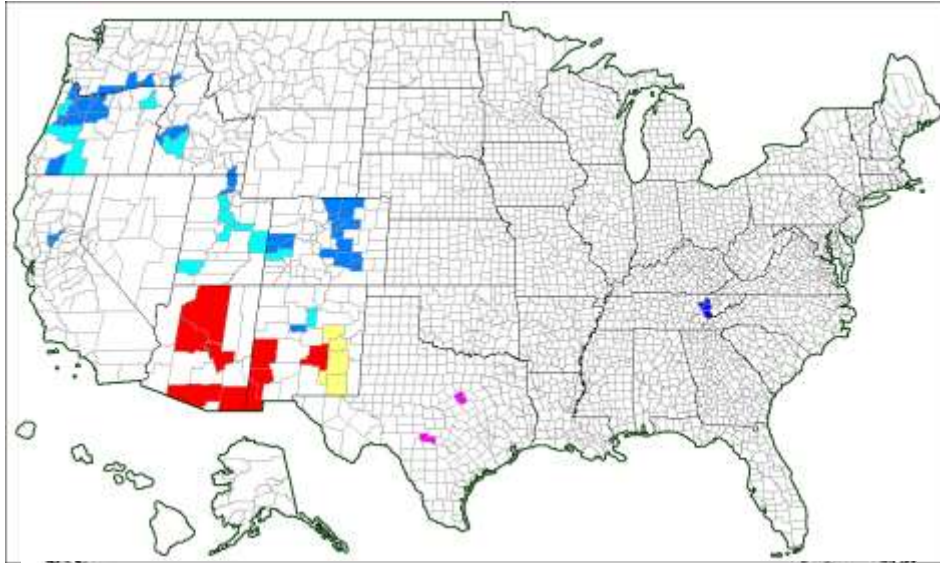
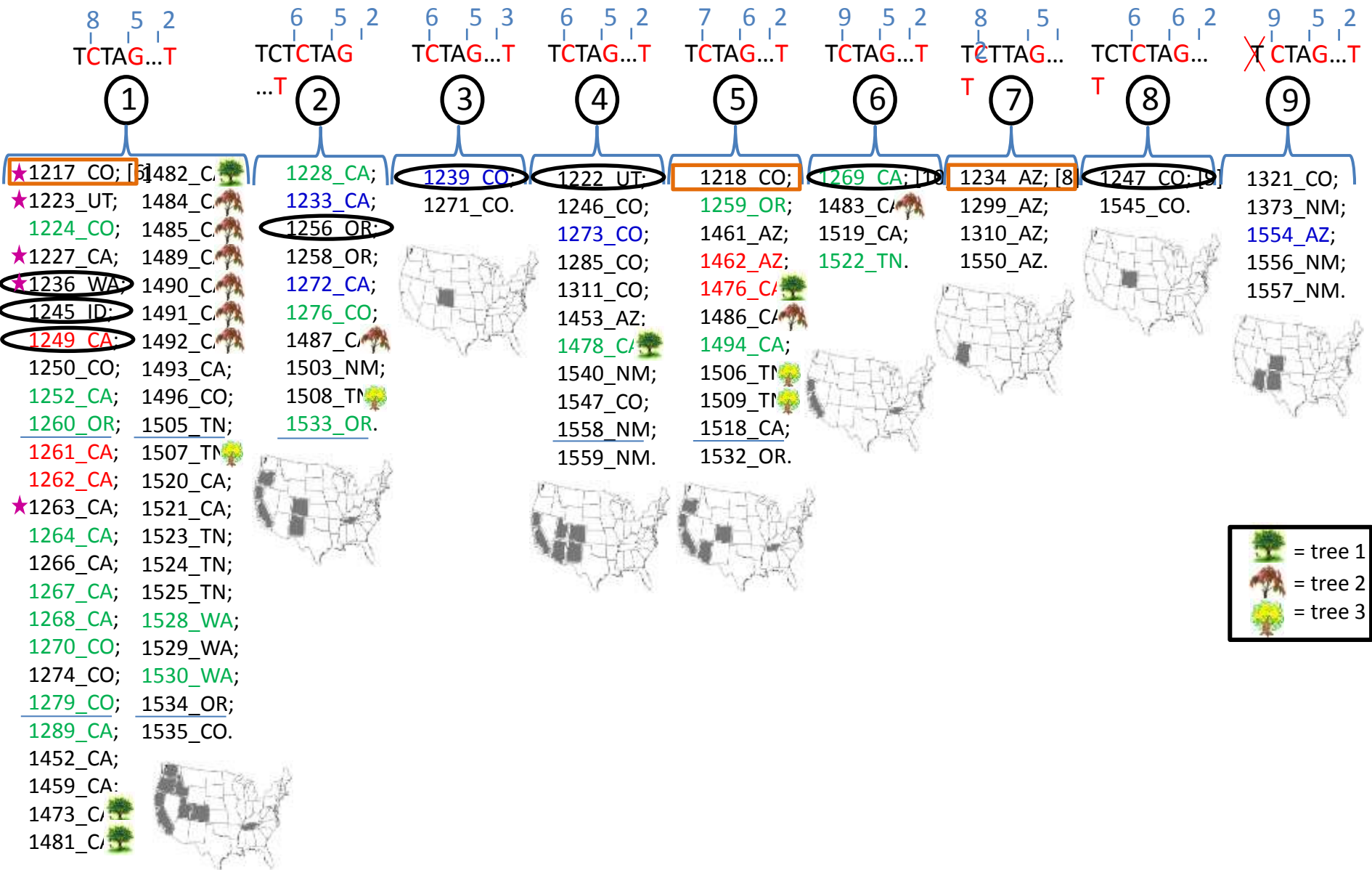
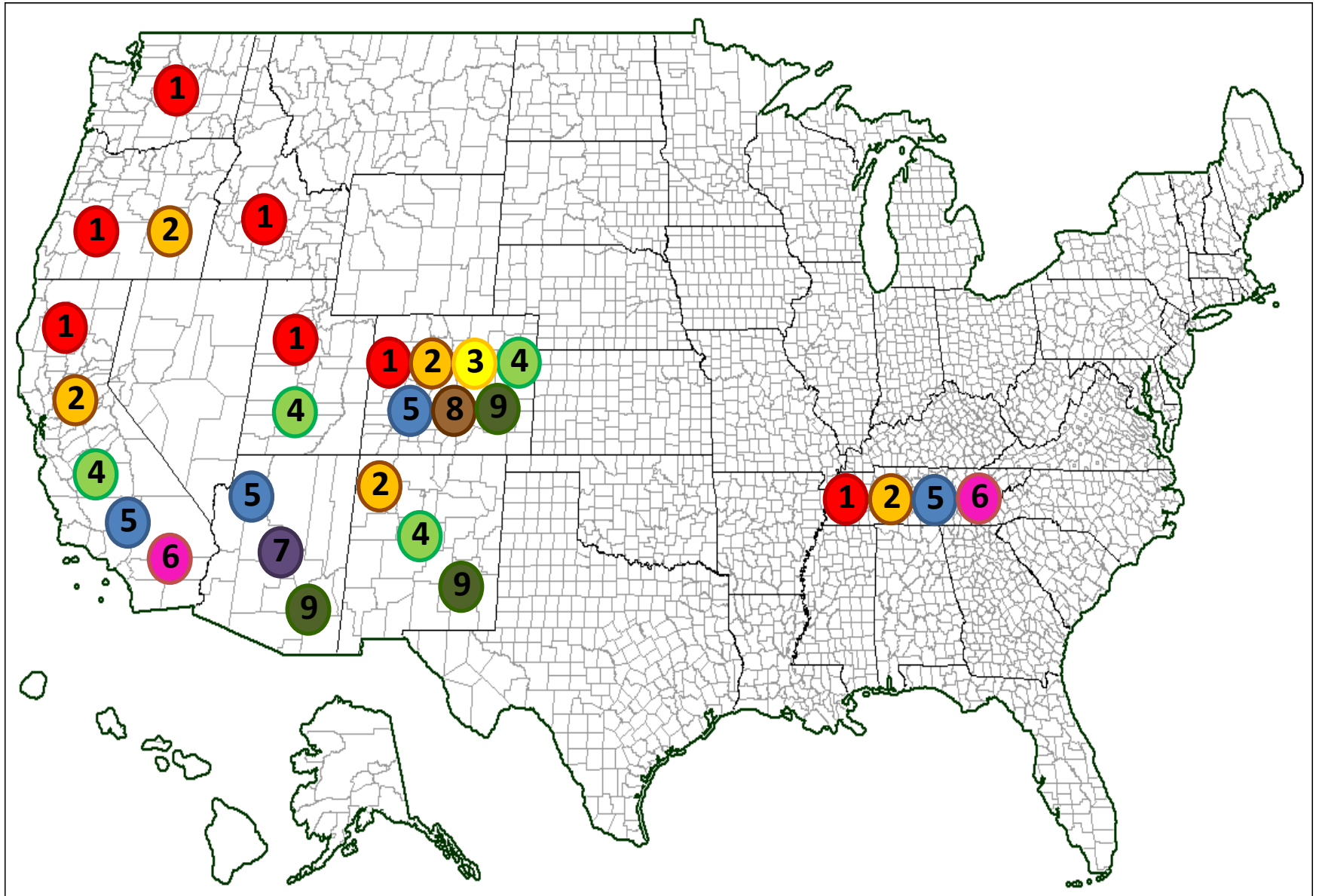


Photo Courtesy Tennessee DNR

Nine haplotypes based on the ITS:



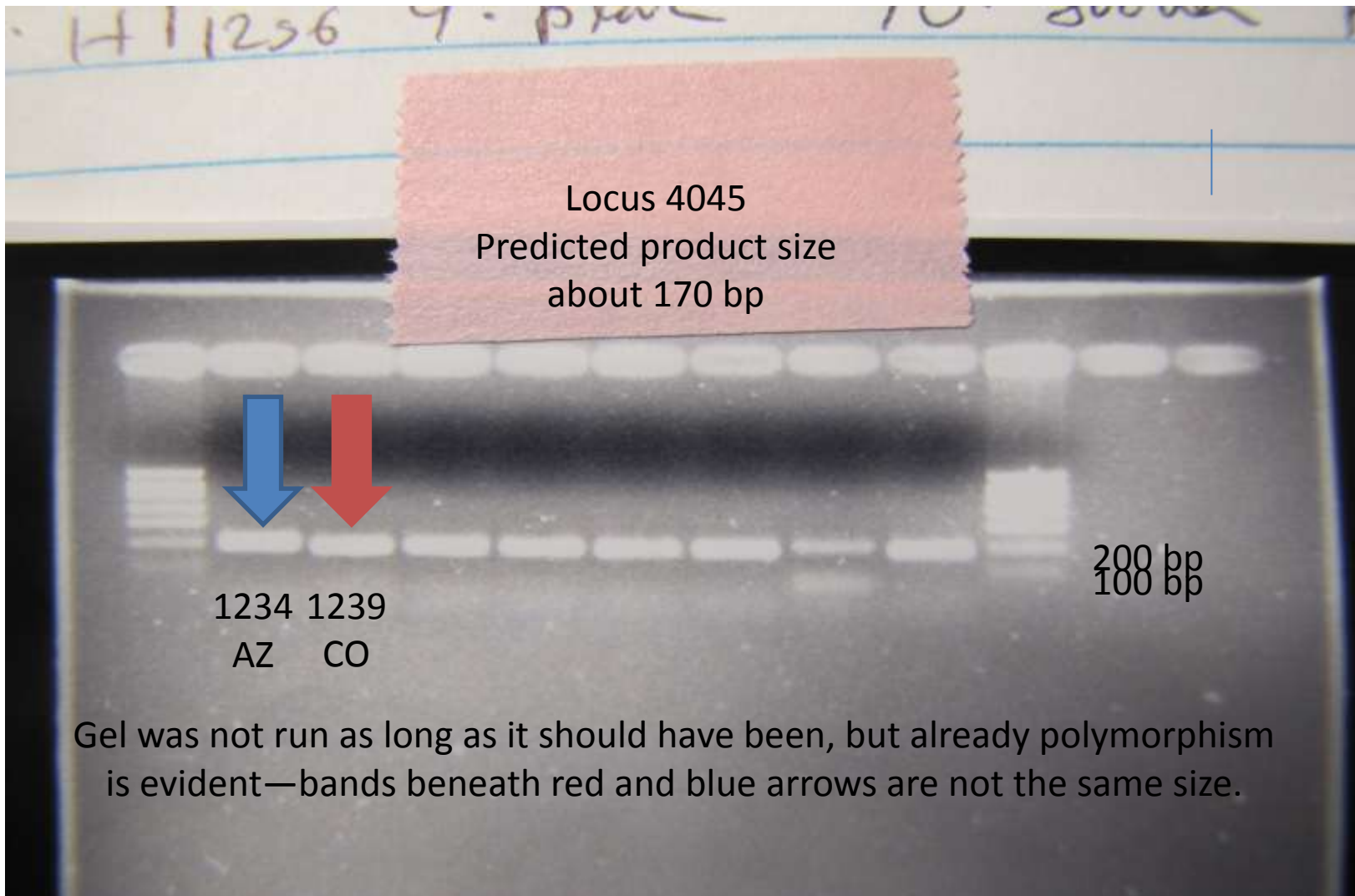
ITS sequence of 99 isolates of *Geosmithia morbida* indicated the presence of 9 genotypes. Sequences share 99% of similarity. Polymorphism and geographical distribution are depicted. When isolated from the same tree, they are indicated.



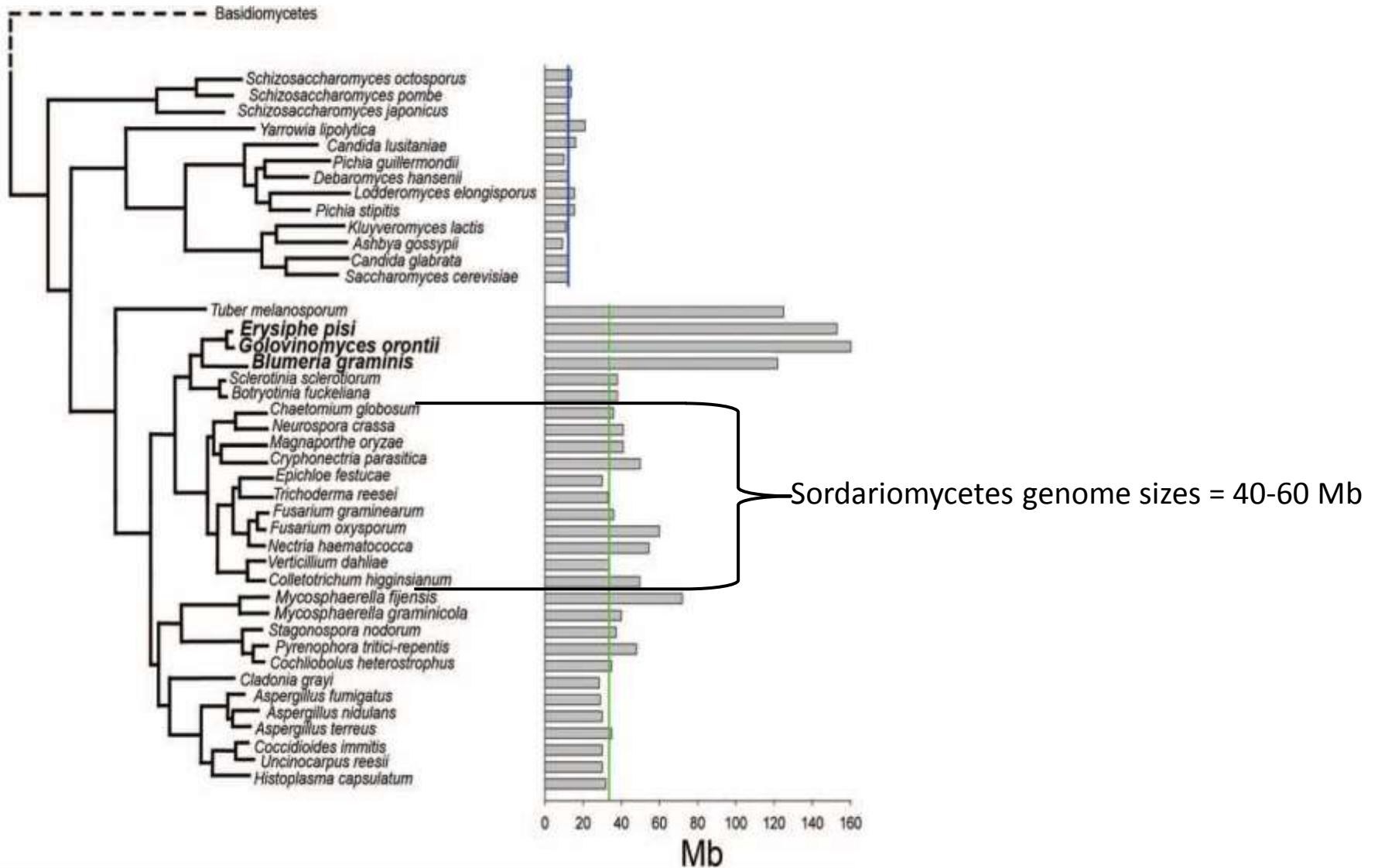
Distribution of 9 different genotypes of *Geosmithia morbida* in nine US states (CA, OR, WA, AZ, UT, ID, NM, CO and TN).

Development of SSR's for genetic diversity

Dr. Keith Woeste, USFS, Purdue



Haplotype genome size of Ascomycetes



Spanu *et al.*, 2010 (Science. 330(6010):1543-6.)

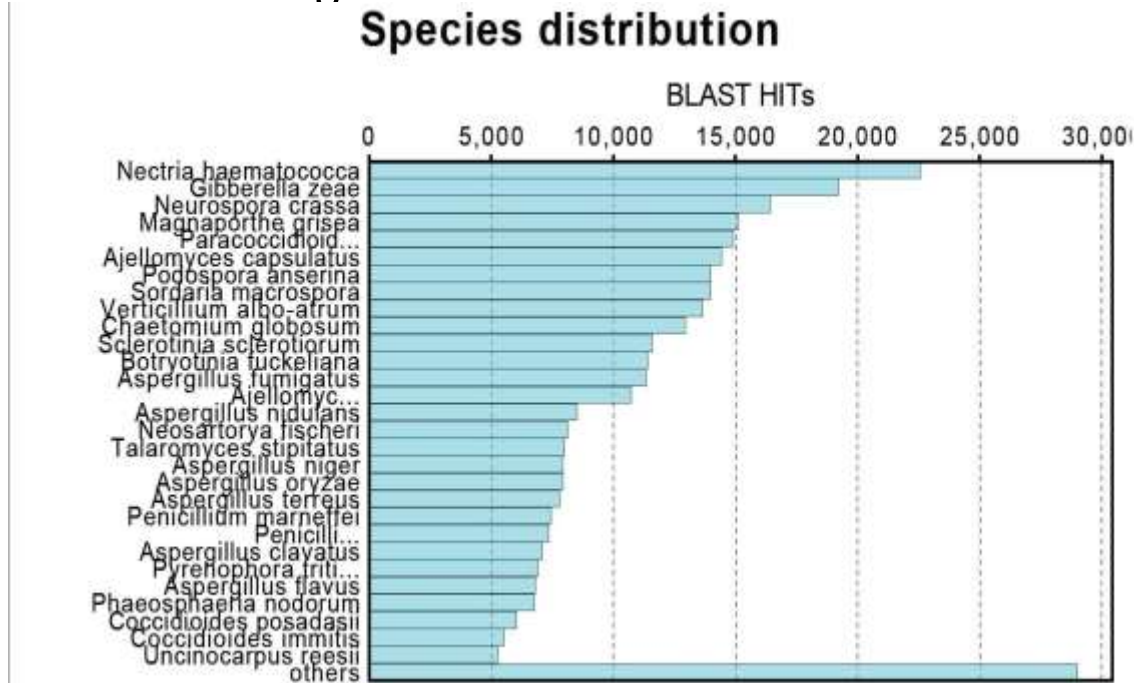
Geosmithia morbida genome estimation is 40-60 Mb.

Geosmithia Genome Project

Marcelo Zerillo and Keith Woeste

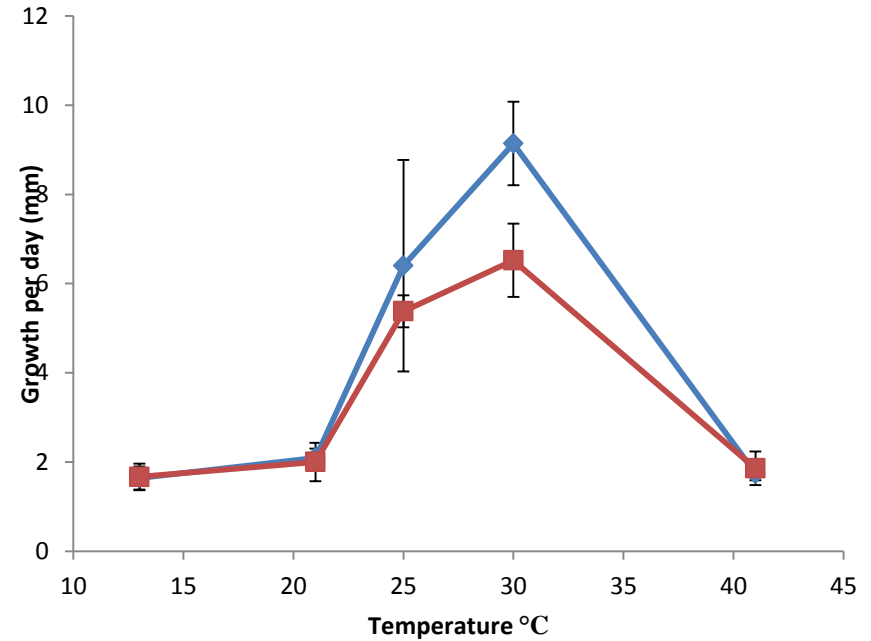
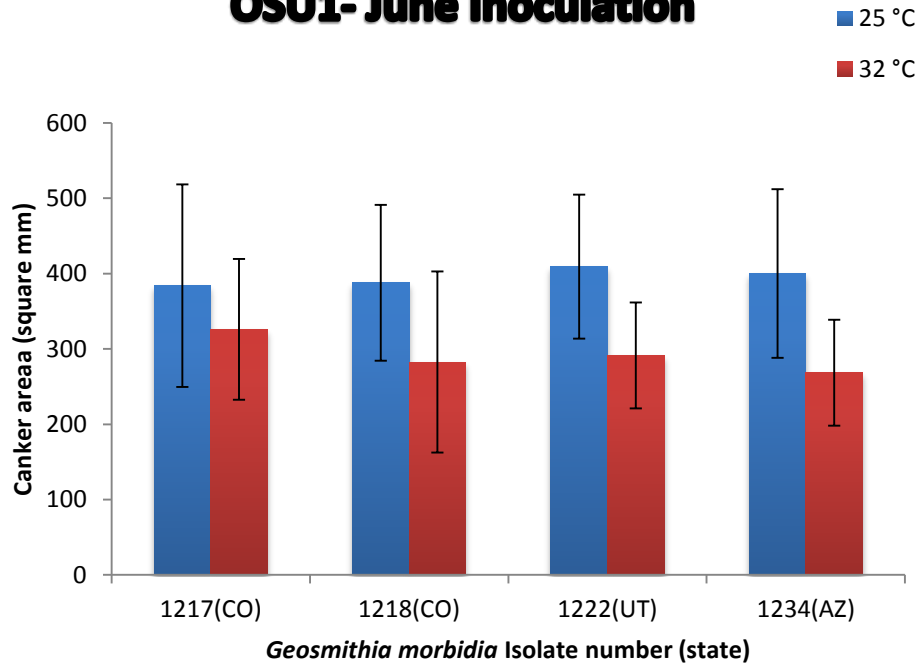
- ½ plate of 454 FLX run;
- 779,000 reads produced;
- 27,933 contigs;
- 16 Mb in contigs (30% of the genome);

- most related genomes:



Geosmithia morbida is thermotolerant

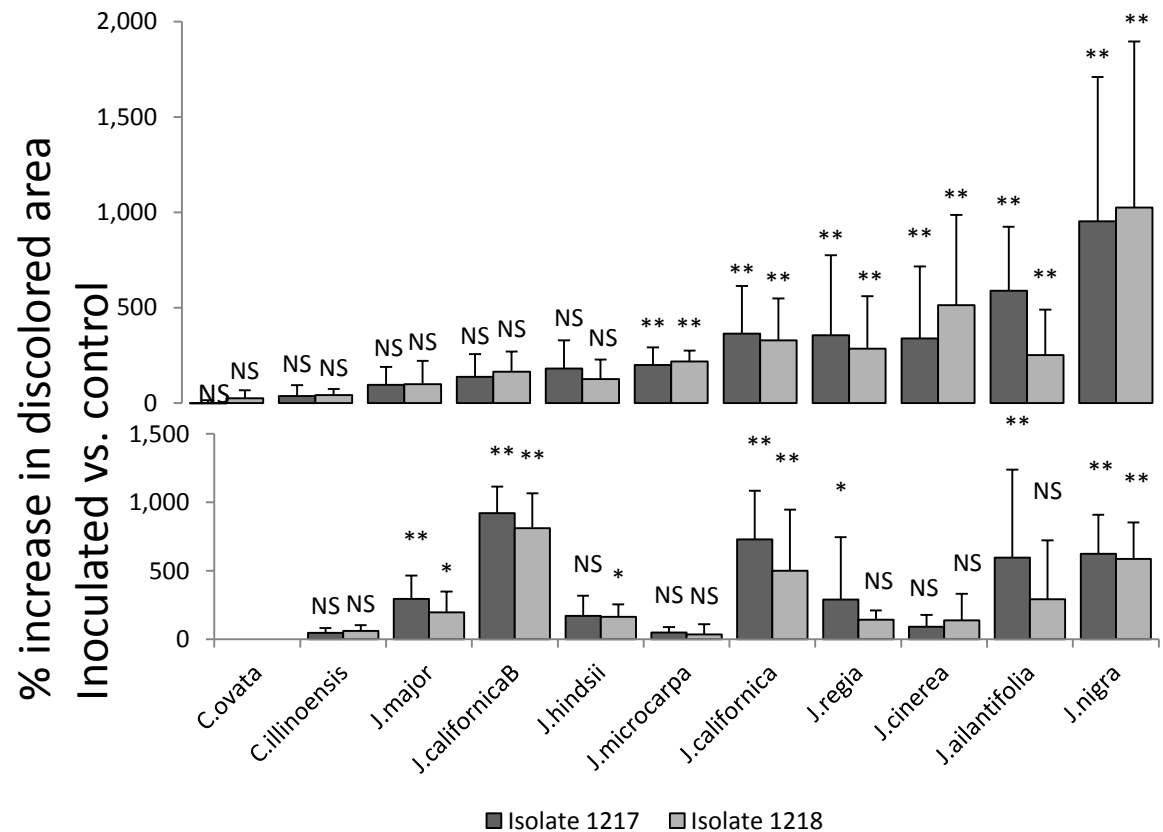
OSU1- June Inoculation



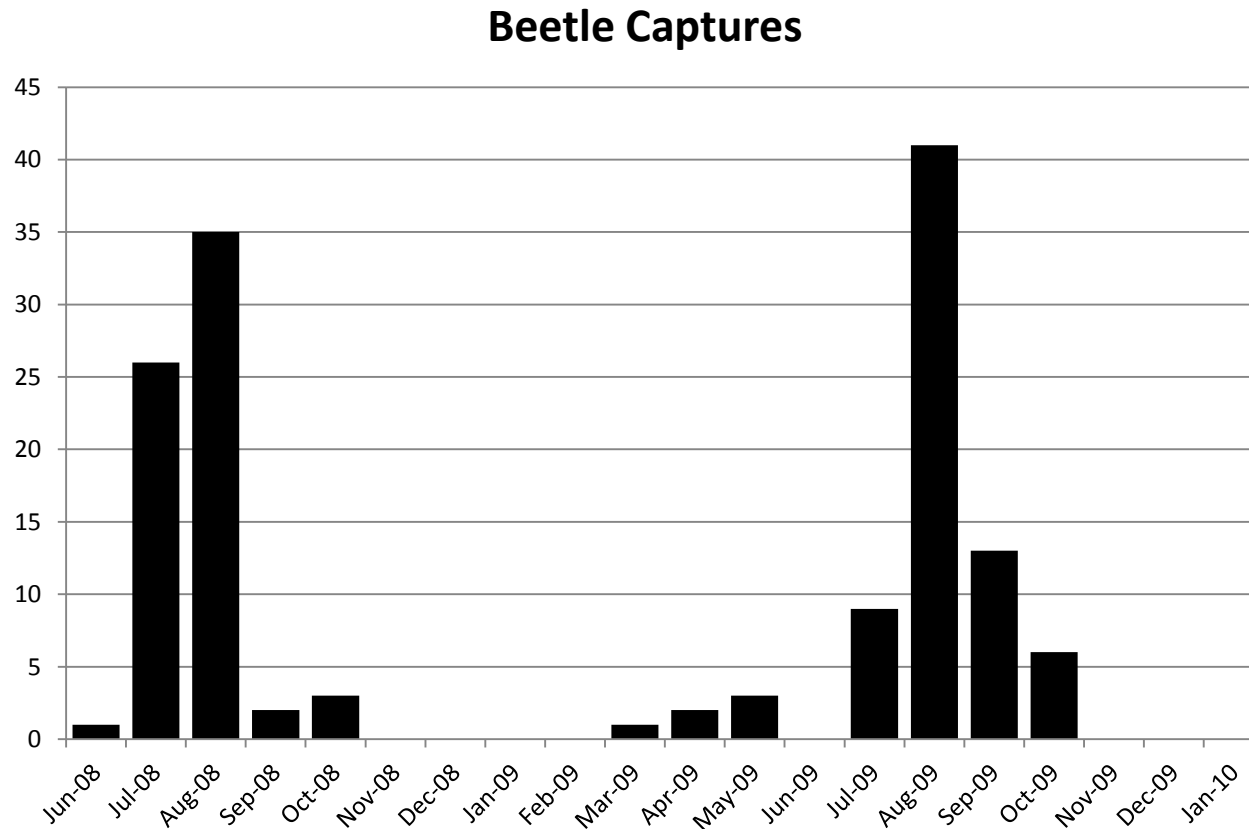
There were no differences in aggressiveness among isolates (different ITS haplotypes and hosts)

Susceptibility of *Juglans* Species

- *Carya* spp. immune
- *J. nigra* susceptible
- *J. major* resistant
- Other species resistant to variable
- **Need studies on reactions to insect!**



- Trapping is very inefficient using yellow sticky traps or funnel traps
 - Currently no effective attractants
- Most beetles caught in late summer



Survival of Walnut Twig Beetle

- At least one year in untreated logs in lab and field
 - Solarization doesn't work
 - Permethrin sprays don't work
 - Clean logs can become infested
- Beetles can survive chipping process



Is There Any Good News?





Surviving Trees in Boulder

Are they resistant?



Support for Outreach and Research on TCD



- USDA – NIFA Critical Issues
- USDA Western IPM Emerging Pests
- USDA- Forest Service
- National Plant Diagnostic Network



United States
Department of
Agriculture

National Institute
of Food and
Agriculture

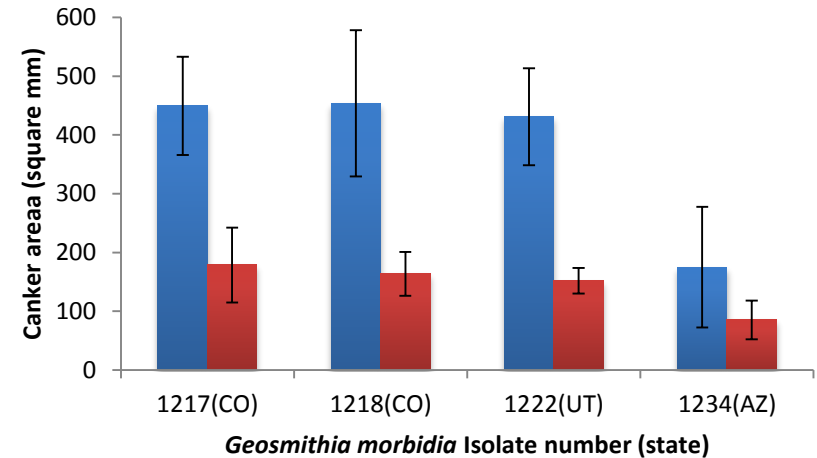
Containment of 1000 Cankers

- Don't move infested logs or lumber with bark attached
 - Beetle survival in logs for at least 10 months
- Don't move fresh wood chips into uninfested areas
- Sanitation in infested areas probably won't completely stop TCD progression

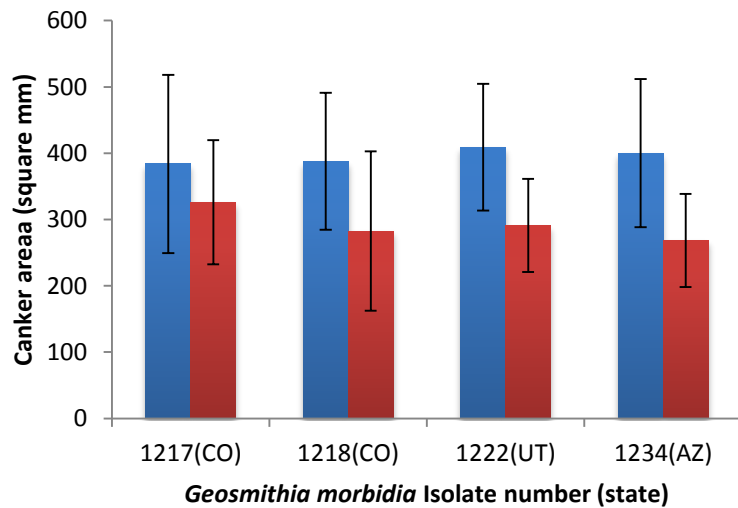


There is a general trend for cankers to develop more slowly at a higher temp

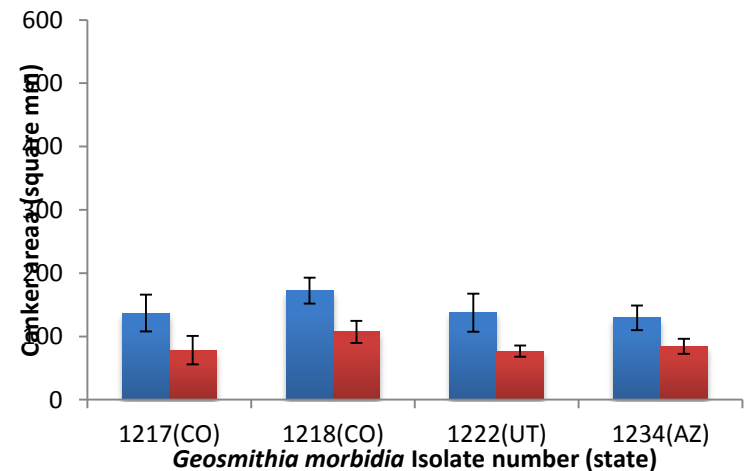
OSU295 - August Inoculation ■ 25°C



OSU1- June Inoculation ■ 25°C



Green 280 - October Inoculation ■ 25°C



Cankers are located in phloem beneath
the outer bark



- Beetle galleries and cankers not evenly distributed on branches or trunk
 - More damage on bottom side of branches
 - More damage on one side of trunk
 - Often west side of tree more damaged
- # galleries and cankers on tree is enormous!!



TCD is Progressive and Develops over Several Years



Juglans hindsii



Juglans californica



Black Walnut Removals in Boulder

