

A microscopic image showing the internal structure of Ambrosia beetle cells. The cells are stained, revealing various organelles and structures. Fungal hyphae are visible, particularly in the upper left and lower right areas, indicating a fungal infection or symbiosis. The background is a uniform reddish-brown color.

# Fungal-Ambrosia Beetle Interactions; Influences on Vectoring

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# *Xyleborus glabratus*



- Recent introduction into Georgia (2002), South Carolina and Florida (2005).
- Limited Range and Hosts.
- Presumed to be vectoring *Ophiostoma* sp.
- *X. crassiusculus* and *X. compactus* found in trees infected with *X. glabratus* associated fungus, *Ophiostoma* (anamorph = *Raffaelea*) sp.

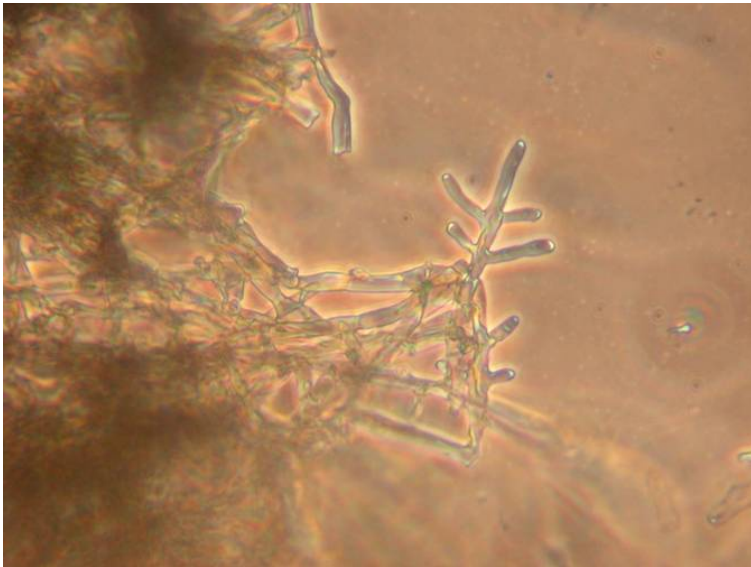
# *Xylosandrus crassiusculus*

- 2.1 - 2.9 mm in length;  
Reddish brown
- Dense confused, minute, declivital granules
- SE, Central, NW USA
- Same primary mycangial fungus as *X. compactus* (black twig borer)
- Obligate mutualism with *Ambrosiella xylebori* exhibiting xylomycetophagy carrying fungi in “sac mycangium”
- Very broad host range



# *Xylosandrus compactus*

- 1.4 to 1.9 mm in length
- brown to black
- distinct punctures on pronotum posterior
- SE USA
- Same primary mycangial fungus as *X. crassiusculus*
- Attacks branches and twigs





# The Questions

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1. Can ubiquitous, widely distributed exotic ambrosia beetles vector the unidentified *Ophiostoma* sp?
  - What interactions may occur between the ambrosia beetles and associated fungi that could affect vectoring capabilities?



# The Questions

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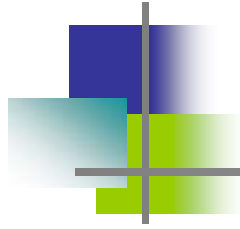
- Rules of Proof for Insect Transmission (Leach, 1940)
  - A close association of the insect with diseased plants
  - The insect also regularly visits healthy plants under conditions suitable for the transmission of the disease
  - Demonstrated the presence of the pathogen in or on the insect in nature or following visitation to a diseased plant
  - The pathogen must be produced experimentally by insect visitation under controlled conditions



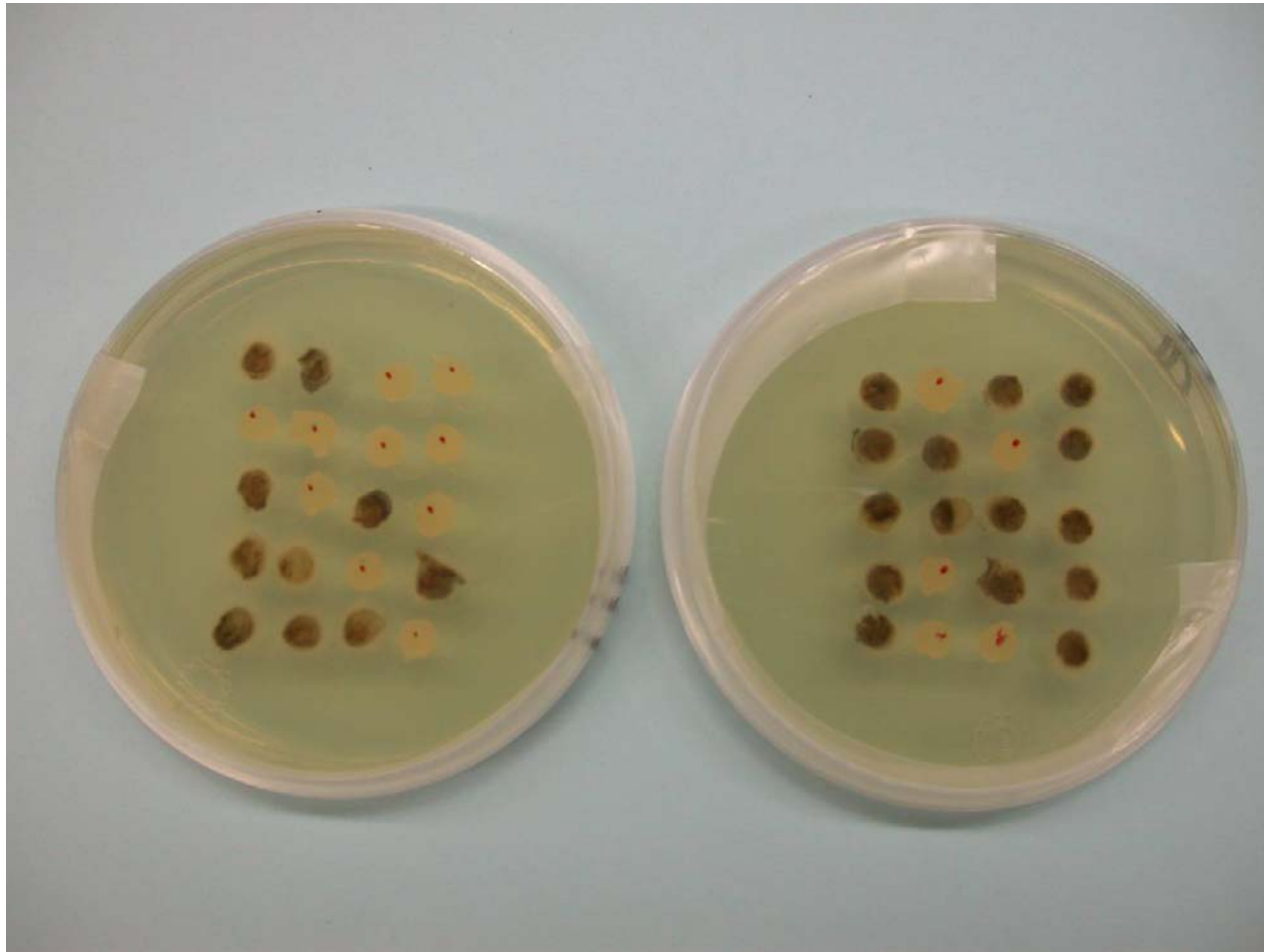
# Fungal Interactions

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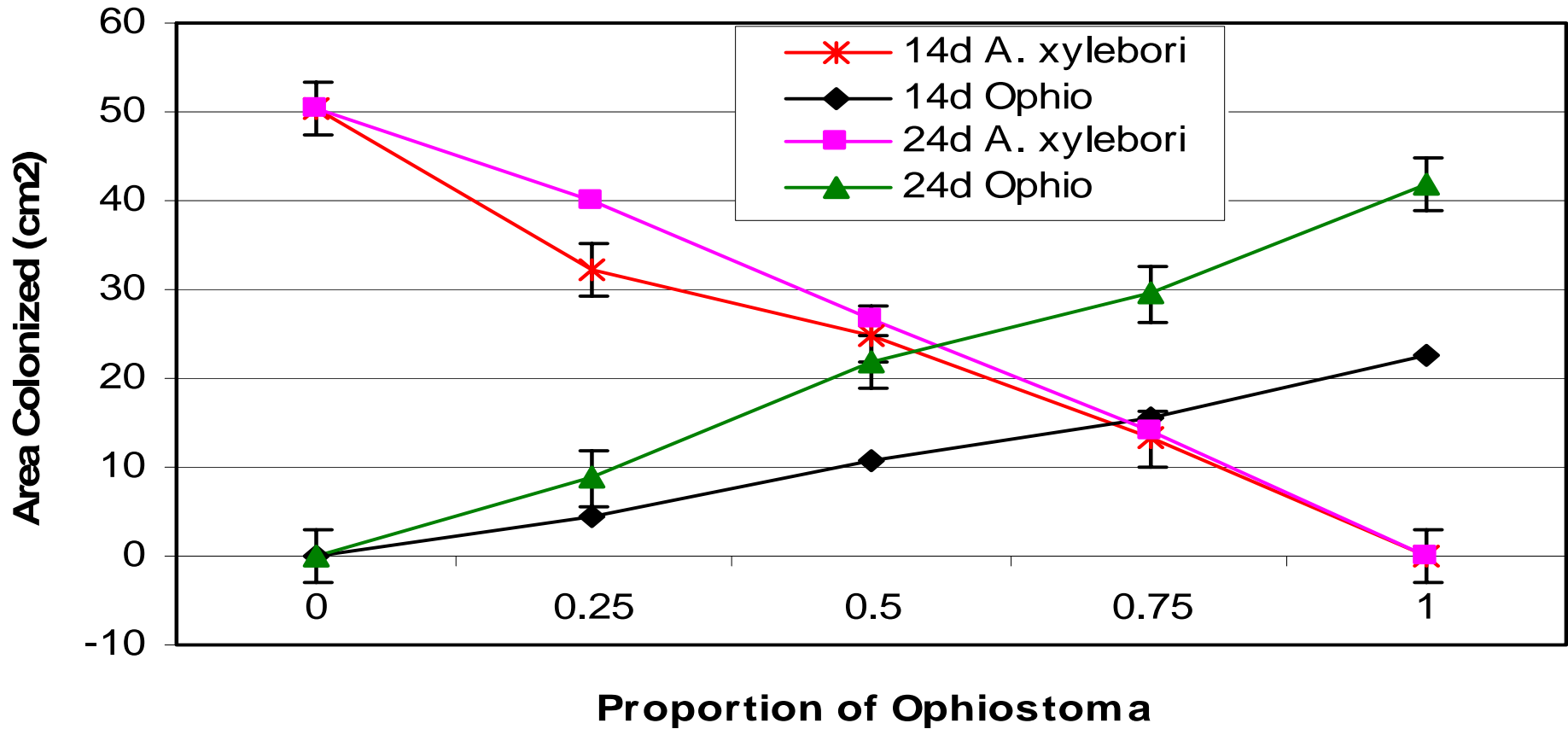
- Competition
  - Differential competition
  - Spatial separation
  - Secondary resource capture
- Vectoring
  - Gallery construction in presence of *Ophiostoma* sp.
  - Phoretic vs mycangial vectoring by *X. crassiusculus*



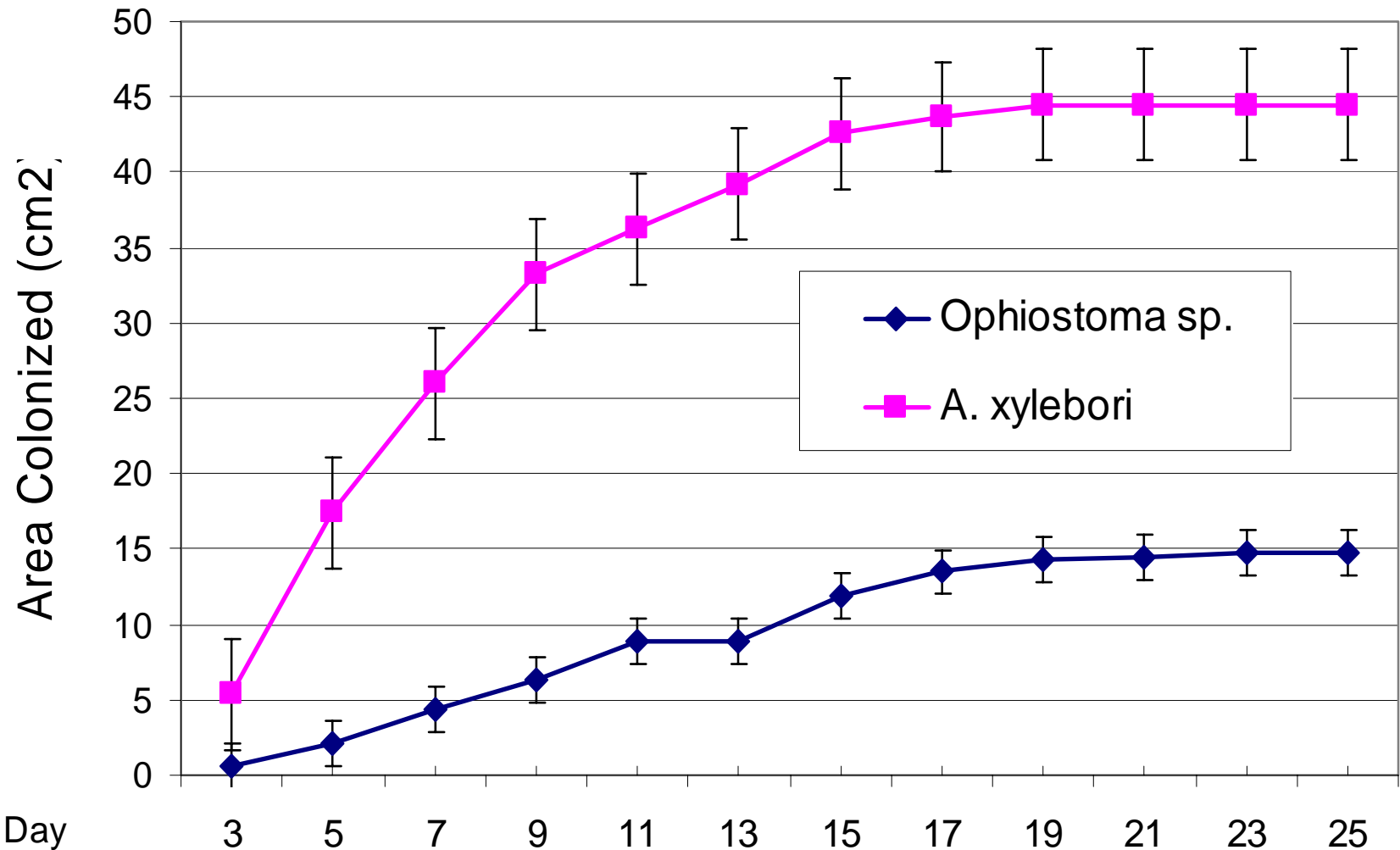
# Differential Competition



# Differential Competition



# Primary Resource Capture – Spatial Separation



Day

1/18/2007



# Fungal interactions

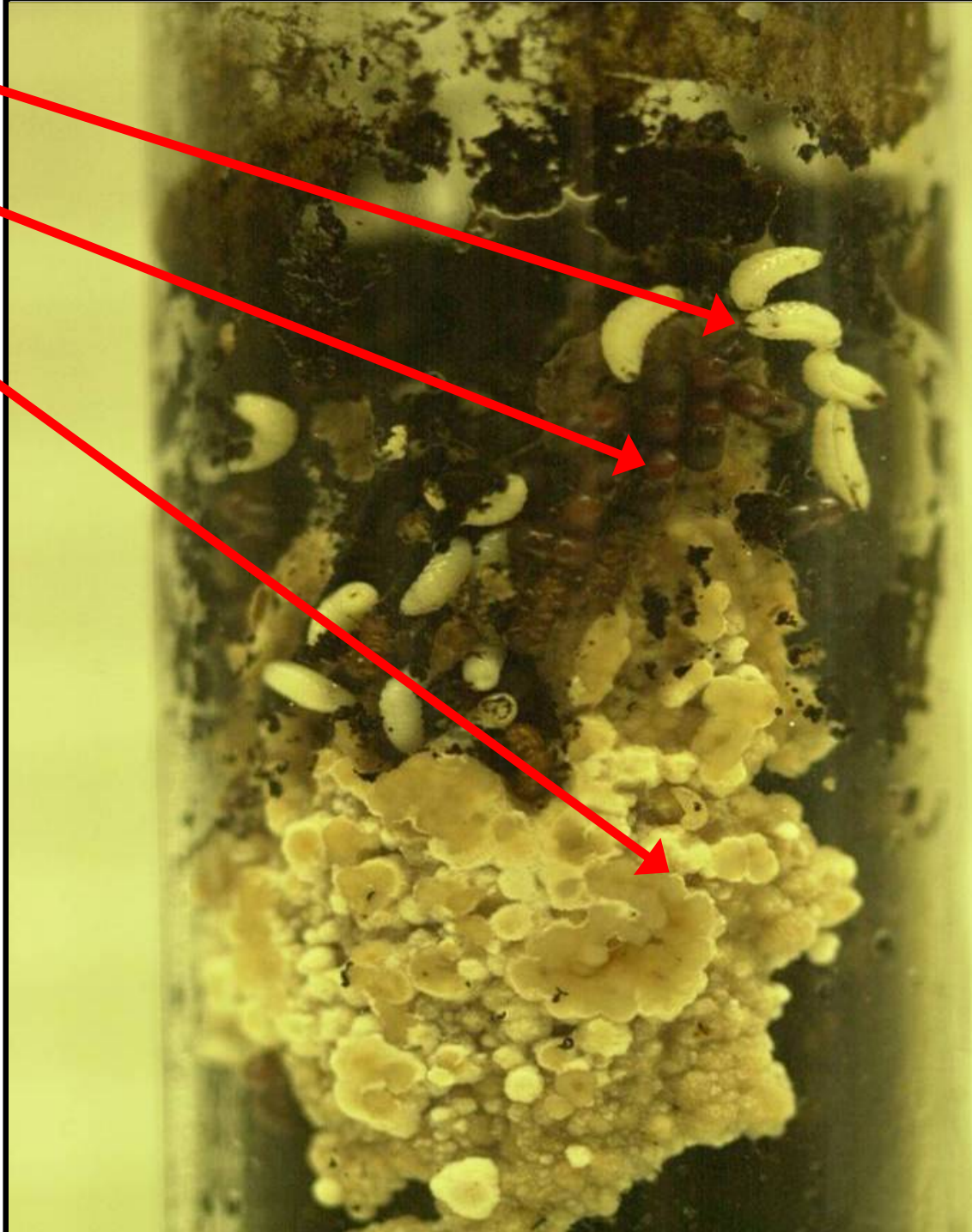
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- What does this mean?
  - *A. xylebori* (mycangial fungus) significantly more competitive
  - Neither fungus exhibited SRC
  - Seem to not to co-colonize host resources. Should keep each other at bay.

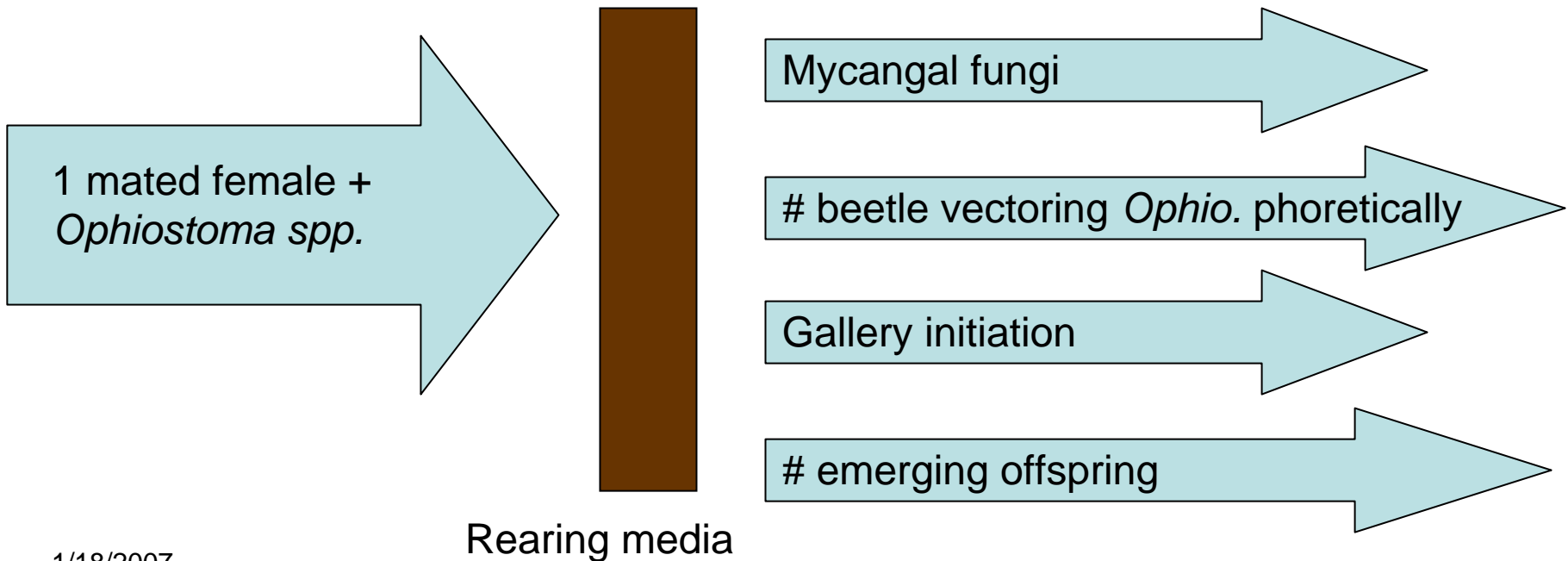
**Larvae**

**Adult**

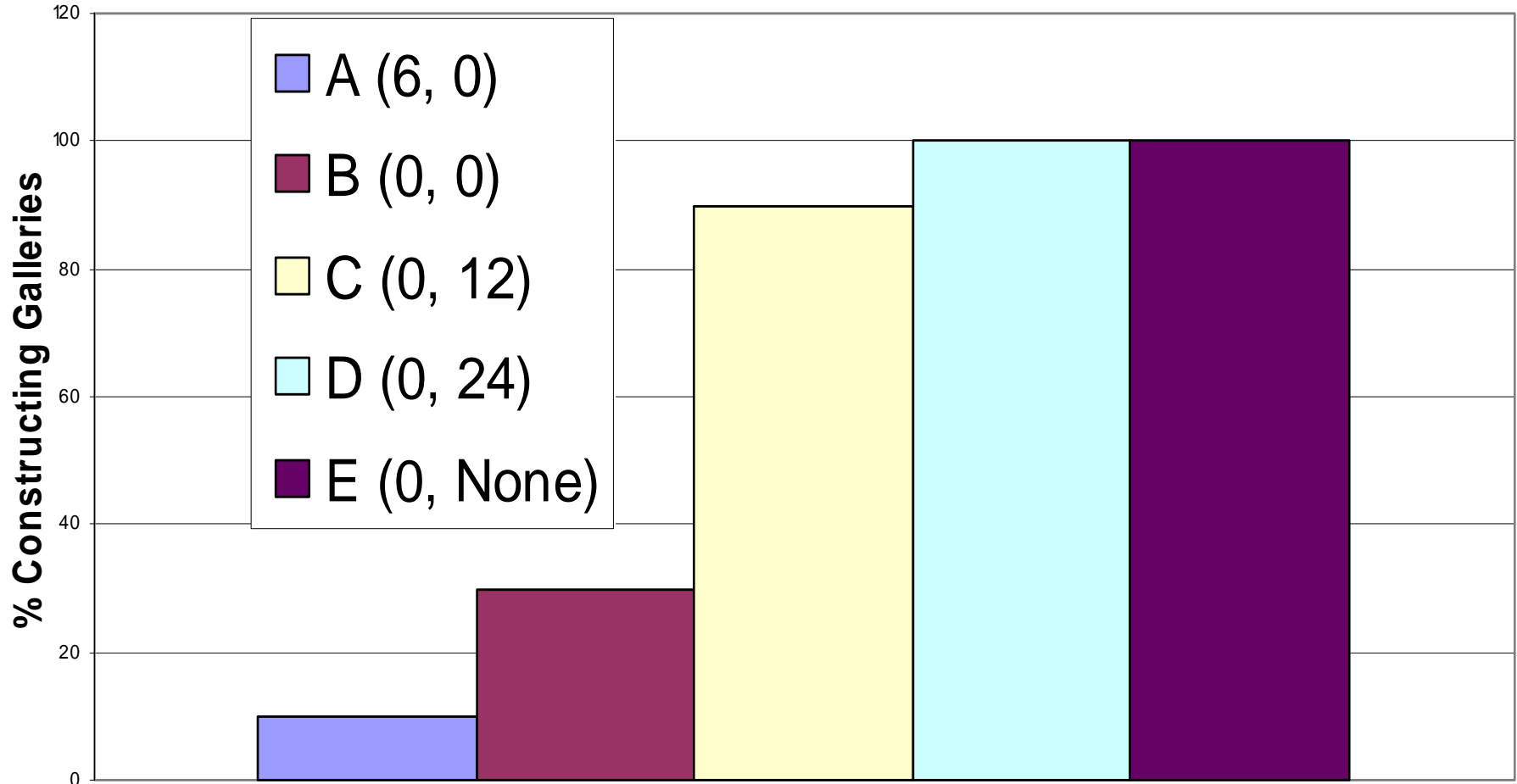
**Mycangial  
Fungi**



Treatment	Treatment Code	day beetles added	day ophiostoma added	% Constructing galleries
A	A (6, 0)	6	0	10
B	B (0, 0)	0	0	30
C	C (0, 12)	0	12	90
D	D (0, 24)	0	24	100
E	E (0, None)	0	NONE	100



# % AB constructing Galleries in a Vectoring Experiment in Artificial Media



Each Treatment in the key is designated as such: (day beetles added, day *Ophiostoma* added). N=15 for each treatment.

# Avg. # Adults Emerging from Vectoring Experiment

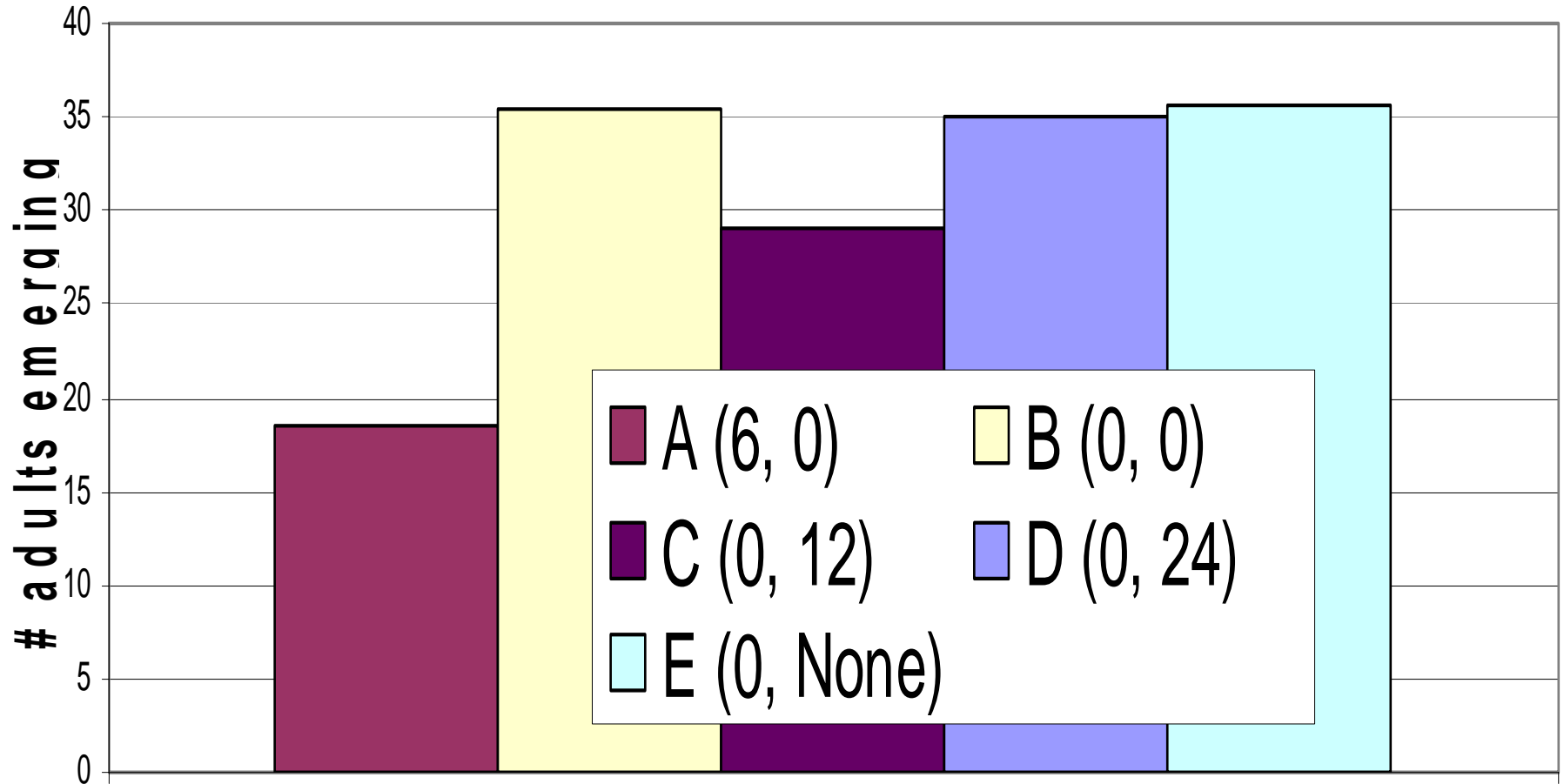
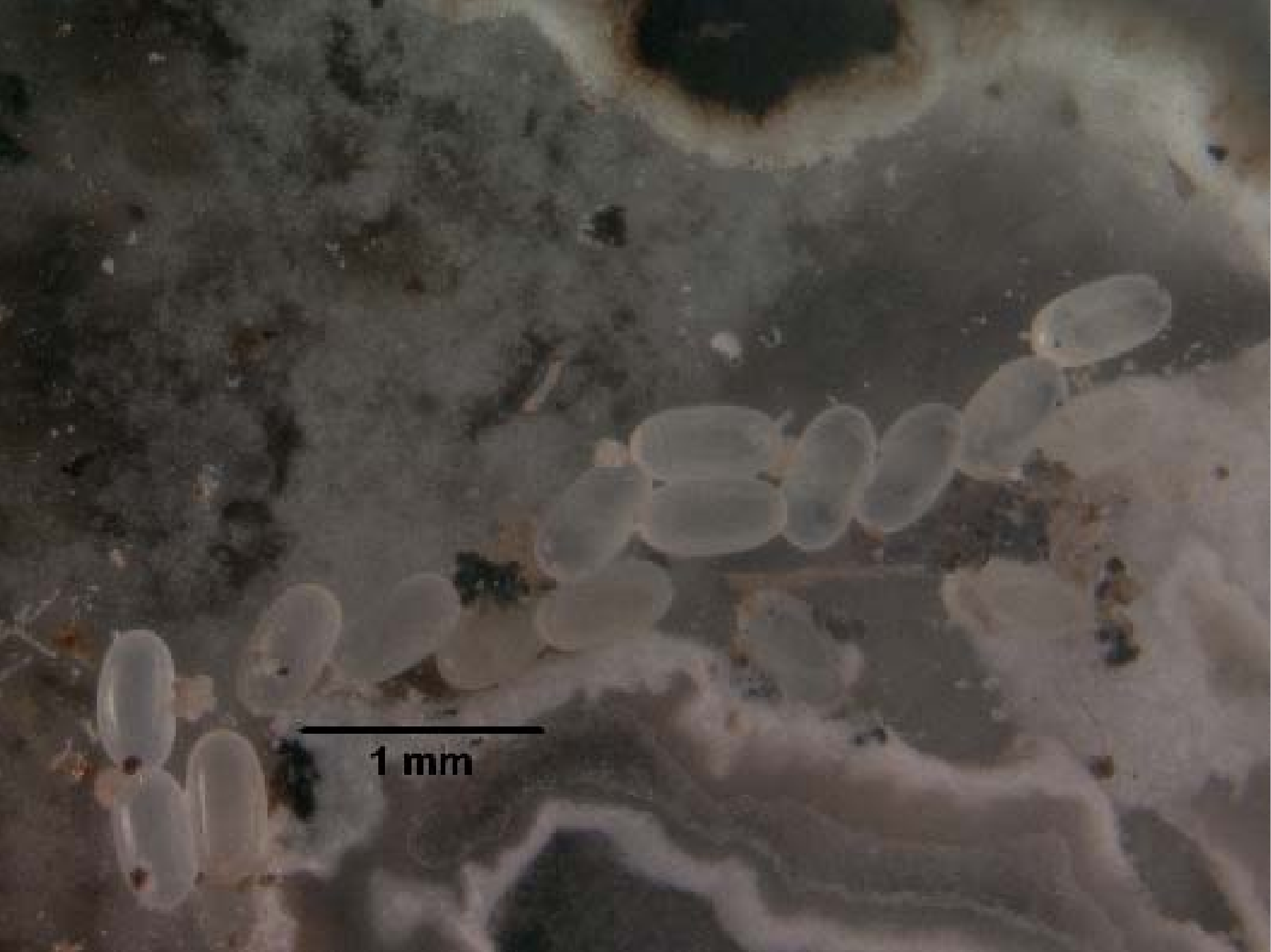


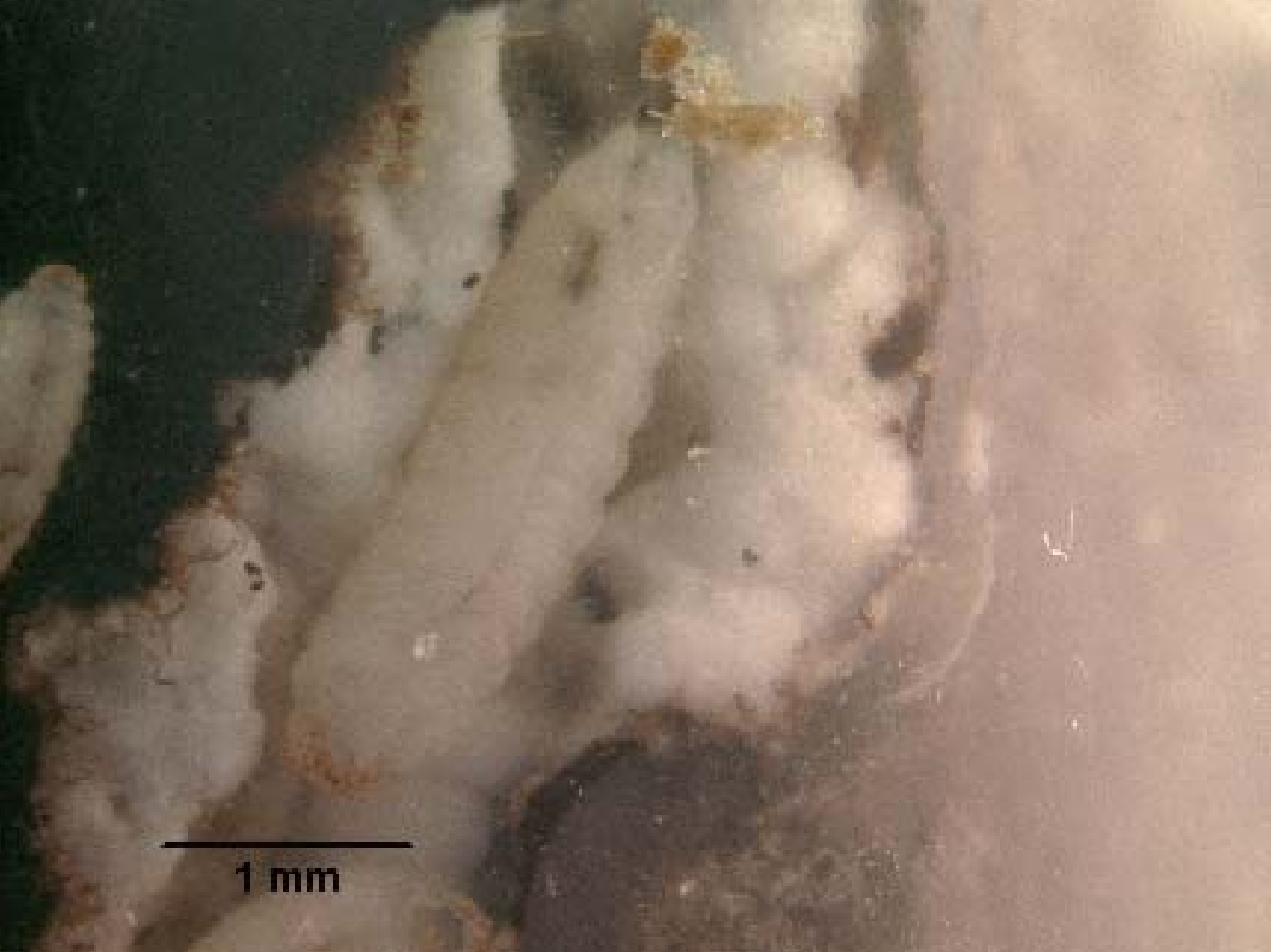
Figure # adults *X. crassiusculus* emerging from *Ophiostoma* addition treatments. Each Treatment in the key is designated as such: (day beetles added, day *Ophiostoma* added).



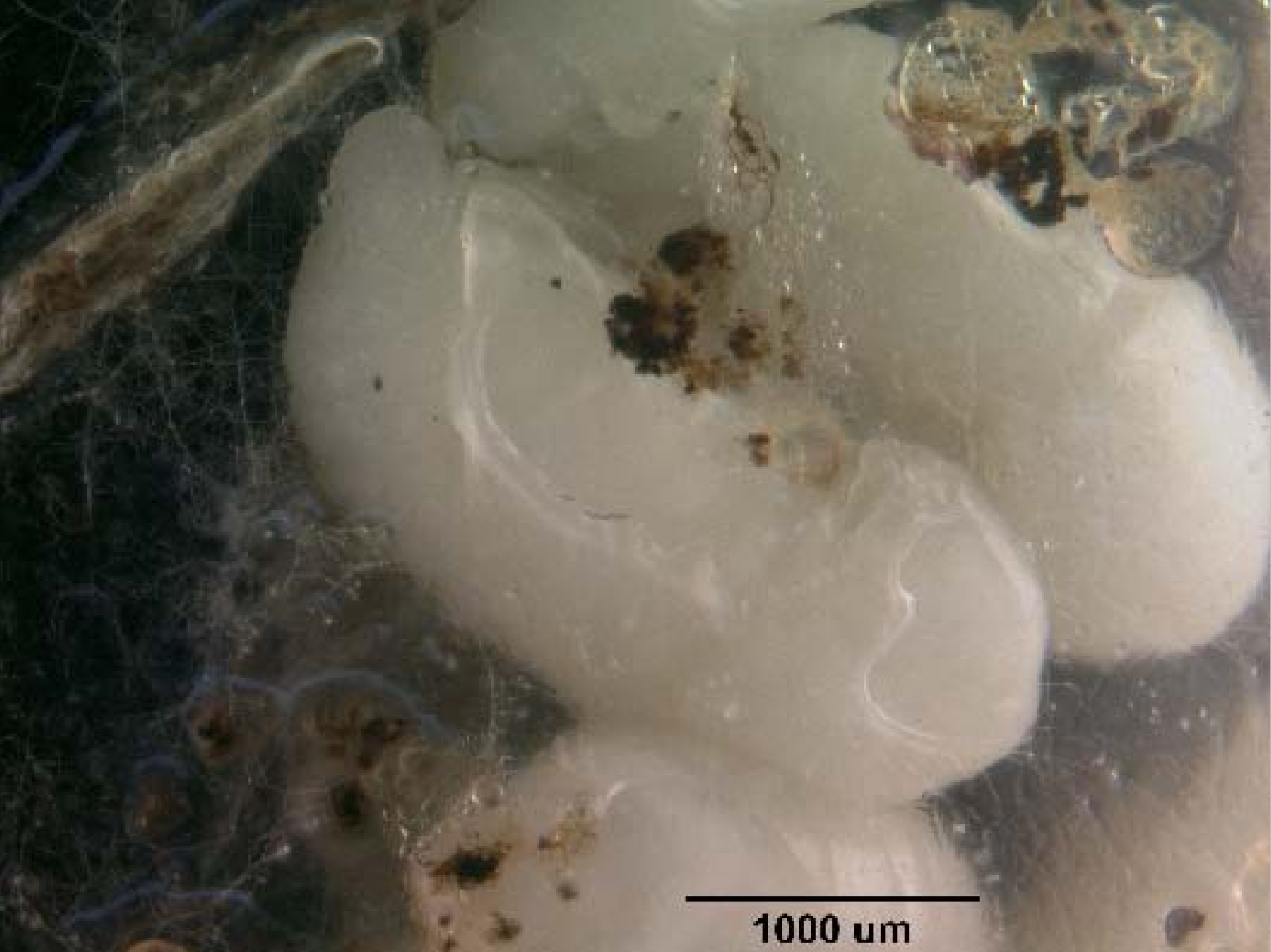
1 mm



1000 μm



1 mm



1000 μm



# Vectoring - Conclusions

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- Timing of attack in relation to each other is important.
- Possible phoretic vectoring warrants additional tests, more closely mimicking the natural system.
- No incorporation of *Ophiostoma* sp. into the mycangia so far (<1% of samples).
- *Ophiostoma* sp. is inhibiting gallery construction of *X. crassiusculus* in the artificial system. Not sure how.
- *Ophiostoma* sp. can decrease brood emergence of *X. crassiusculus*. Resource utilization.



# Recommended Future Work

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- Replicate Vectoring Lab Experiment.
- Experiment in Quarantine facilities in natural media (Redbay wood).