BMSB in Vineyards and Wines

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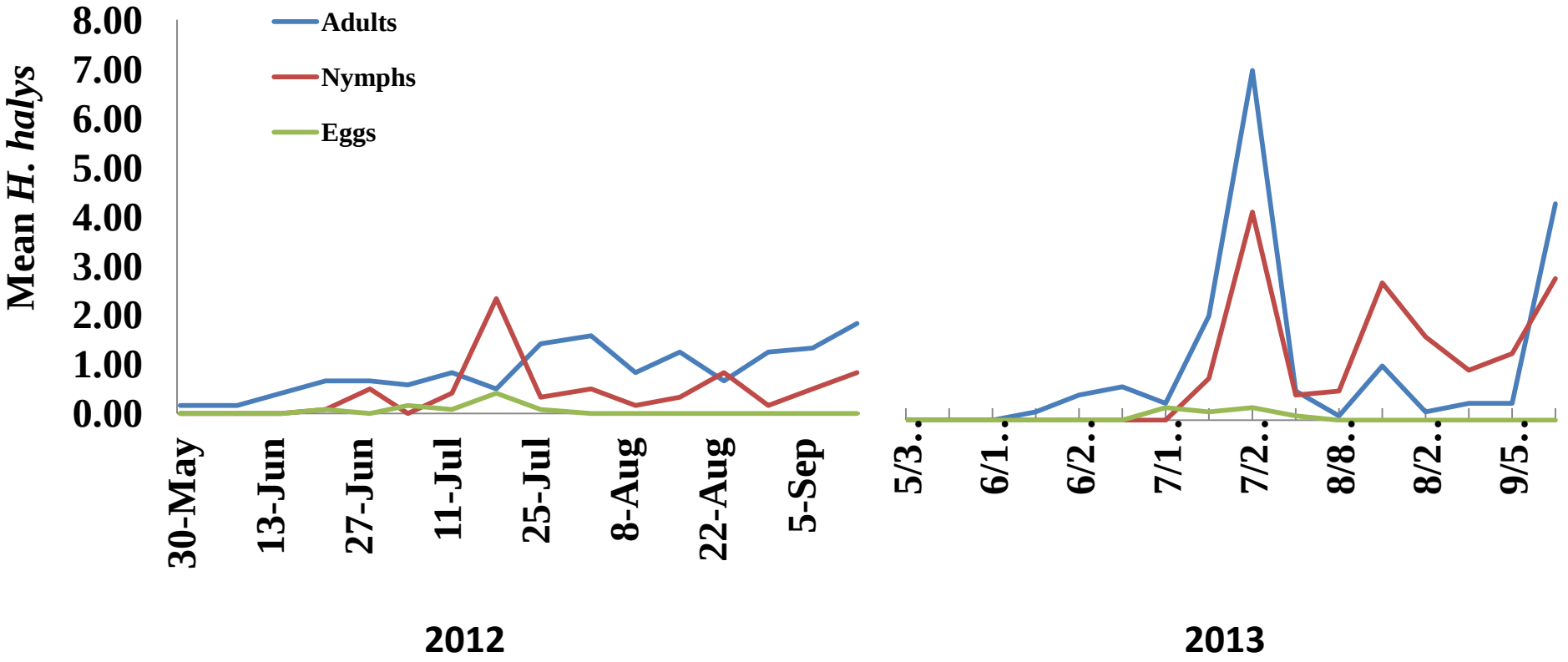
Research Questions for BMSB in Vineyards

- **Phenology, Impact in Vineyards**
- Economic Impact:
  - Injury to berries
  - Introduction of rots, other pathogens
  - Delays in postharvest sorting
  - Contamination of wine at crush
  - Nuisance in wine tasting rooms
- Control tactics

Phenology in vineyard 1

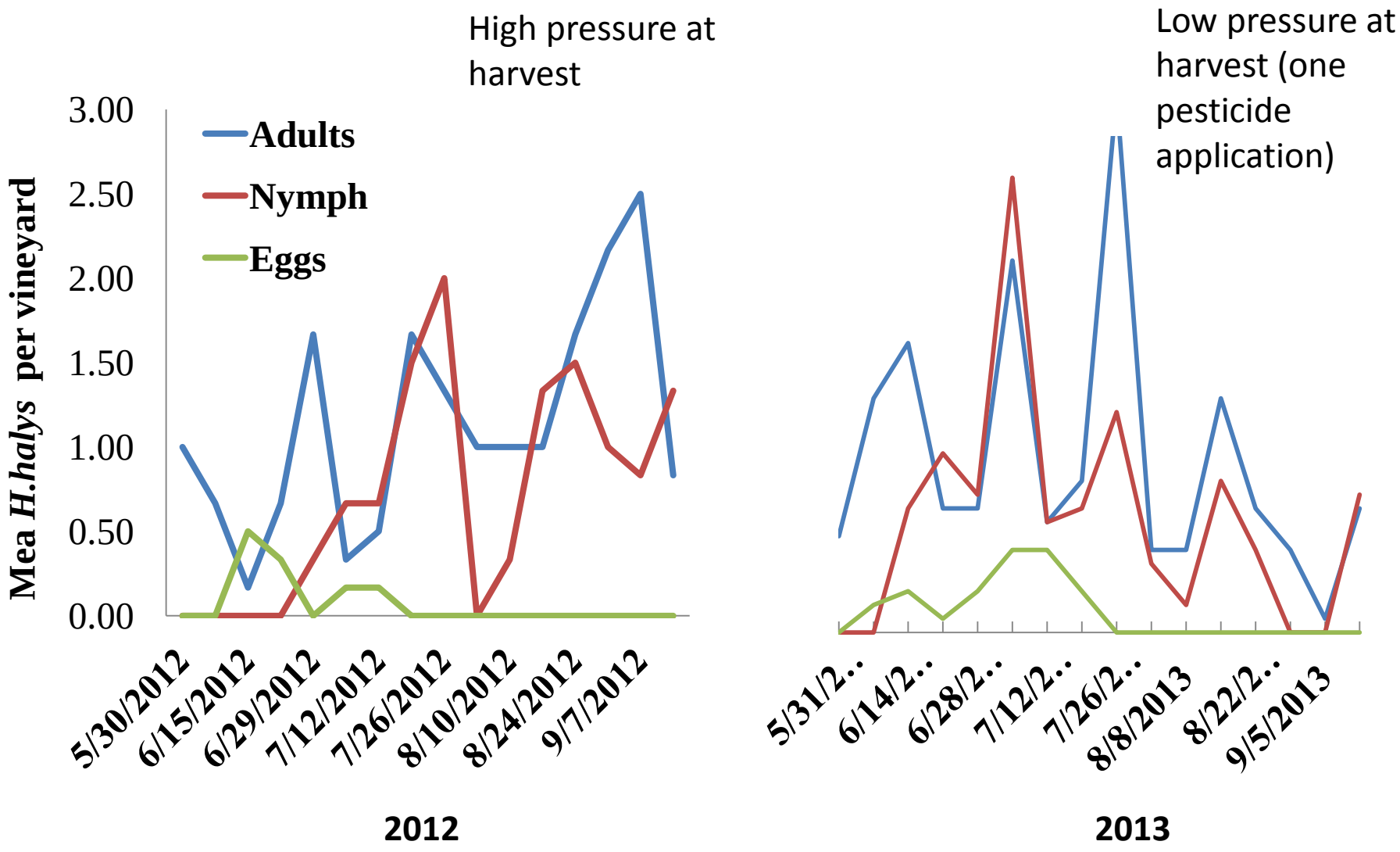
High pressure at harvest (1 pesticide application)

Low pressure at harvest (2 pesticide applications)



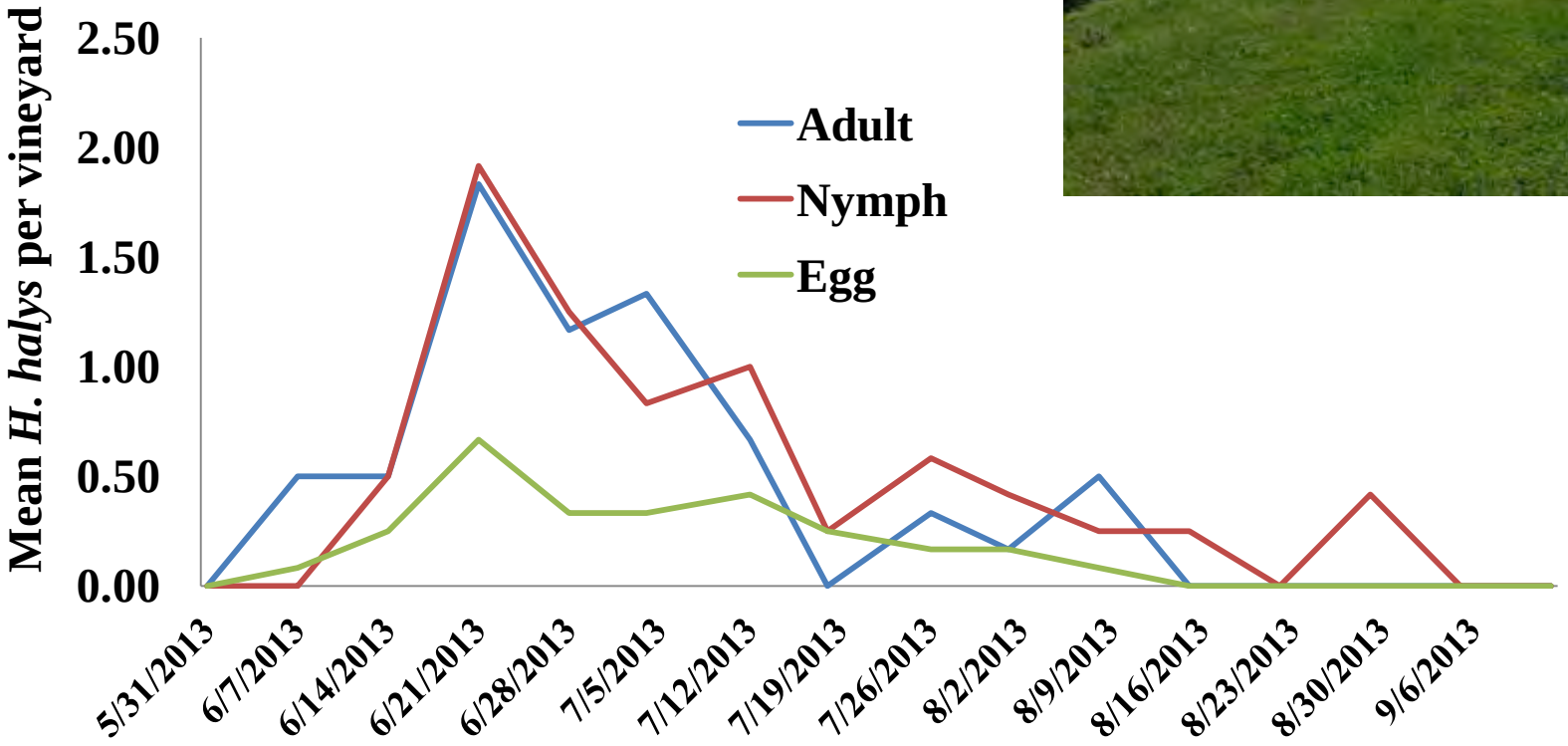
Surrounded by woods all sides, Virginia

Phenology of BMSB in Vineyard 2

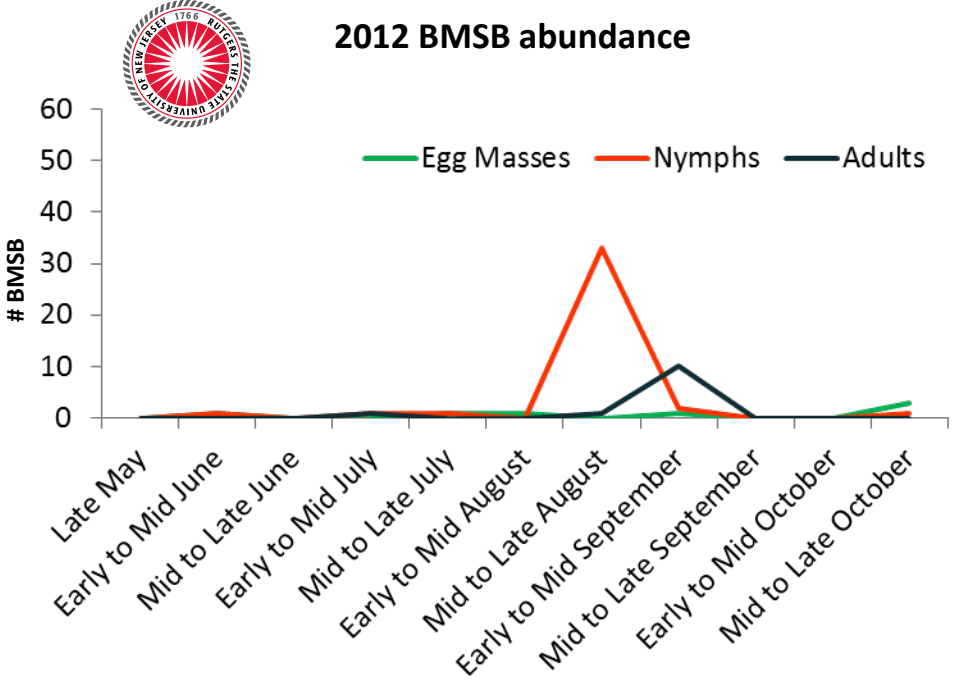


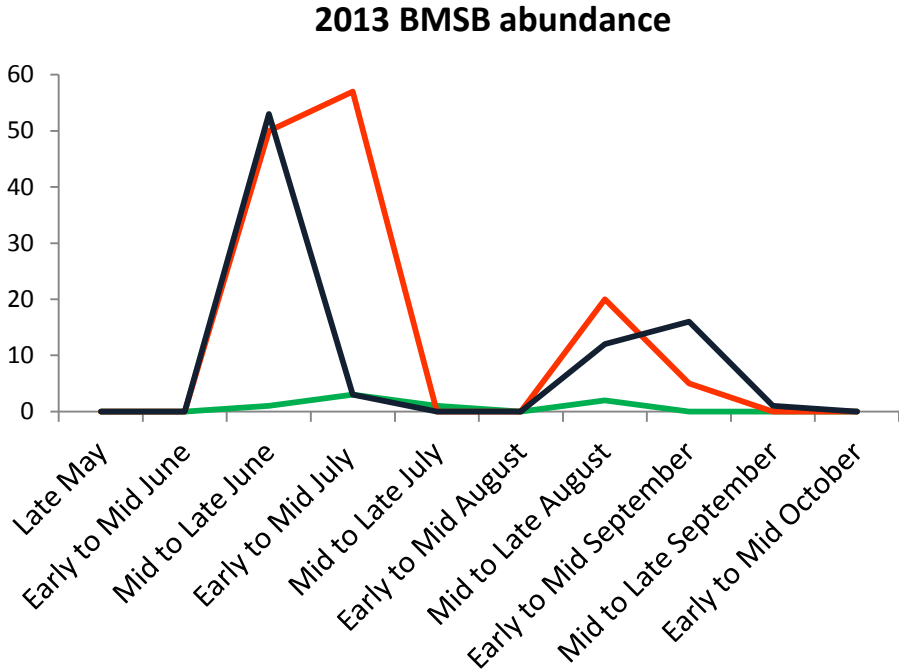
Surrounded by woods three sides, pasture the fourth

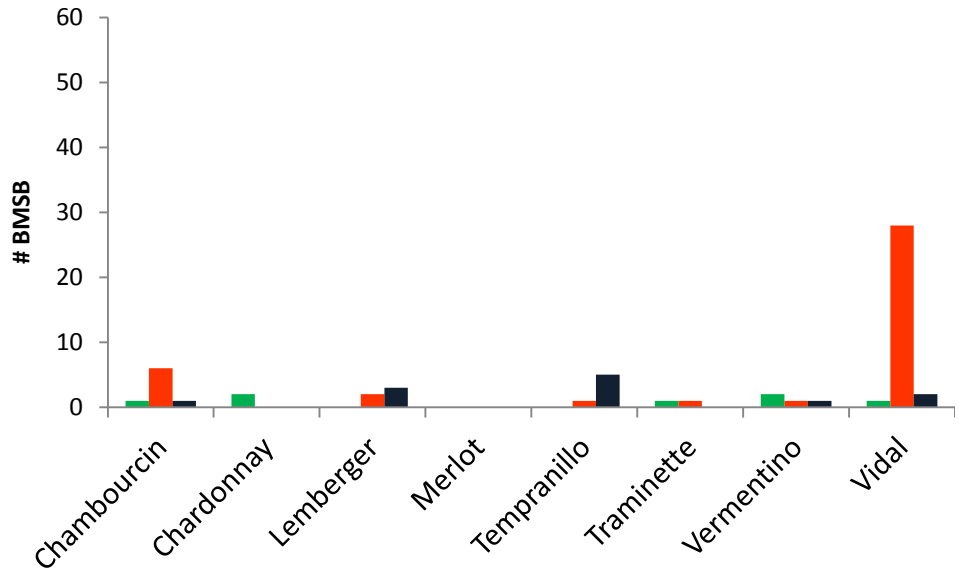
Phenology of BMSB in Vineyard 3, 2013

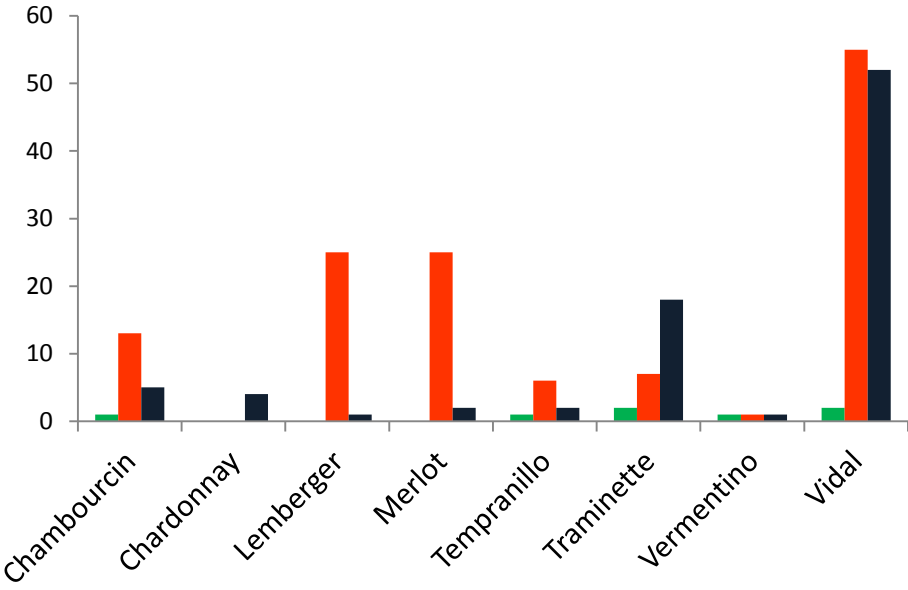


Low pressure during harvest, high BMSB in adjacent Soybean



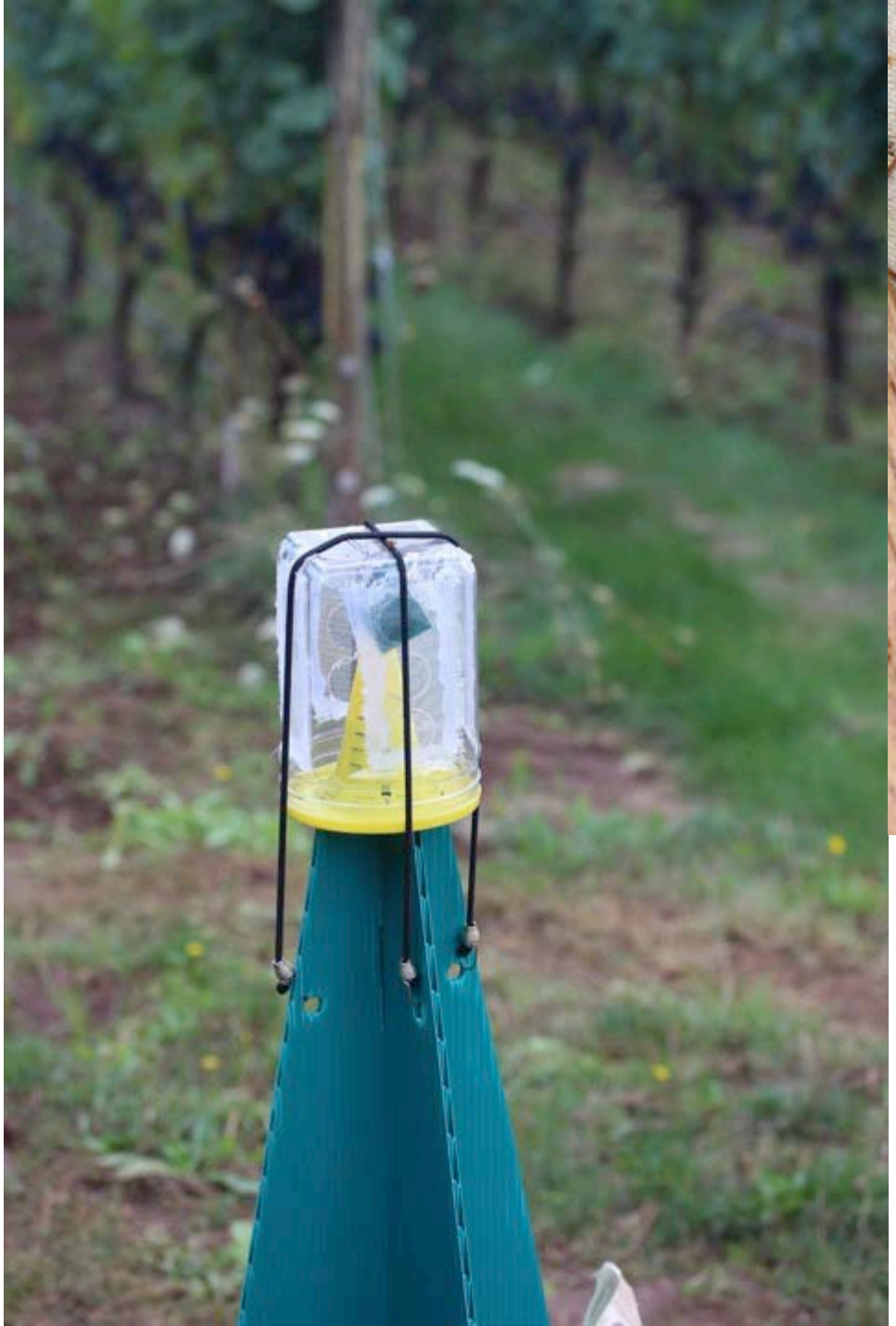






Most abundant in white grapes, from mid-June to mid-July and from mid-August to mid-September

Oregon: Populations build up in late season



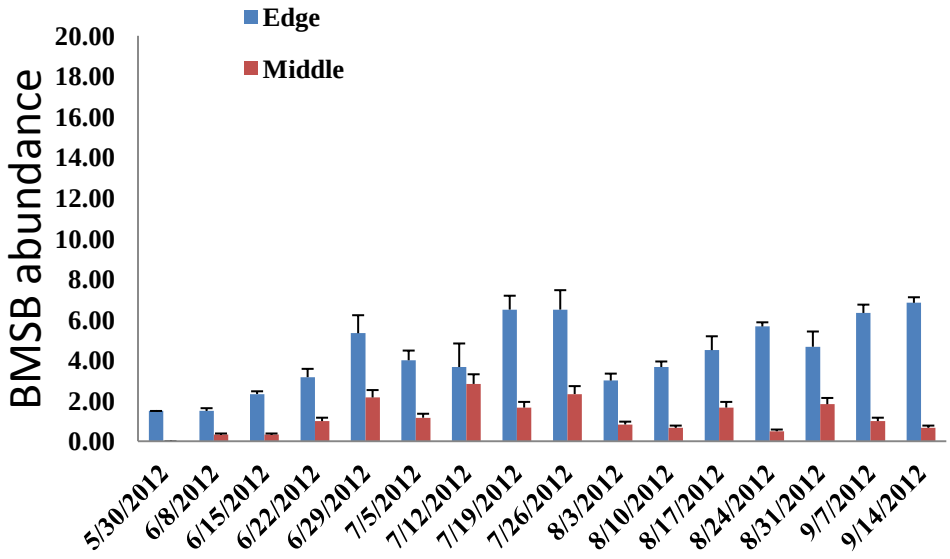
Photo’s: Walton

Pheromone-baited pyramid traps and systematic beat sheeting

Edge effects, 2012/2013

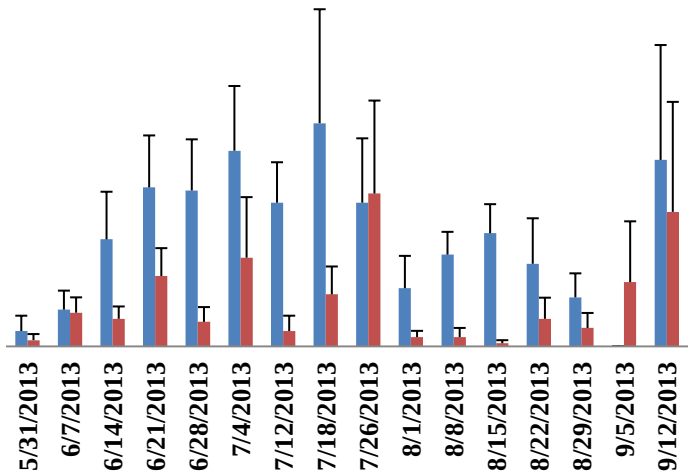
- Edge & middle Weekly three-minute timed count visual sampling

Edge effect



2012

$F = 47.45$, df = 1, 8, P = 0.0095



2013

$F = 21.35$, df = 1,8, $P = 0.0017$

- There was significant edge effect regardless of the time
- ✓ 2012 ($F = 1.62$, df = 3.2, 26.2 and $P = 0.20$)
- ✓ 2013($F = 1.4$, df = 4.2, 33.8 and $P = 0.02$).

Key phenological trends

- Egg masses collected from early June to mid-July
- Populations peaking at early veraison
- BMSB high at harvest depending on control program
- BMSB abundance inside vineyards affected by surrounding landscapes

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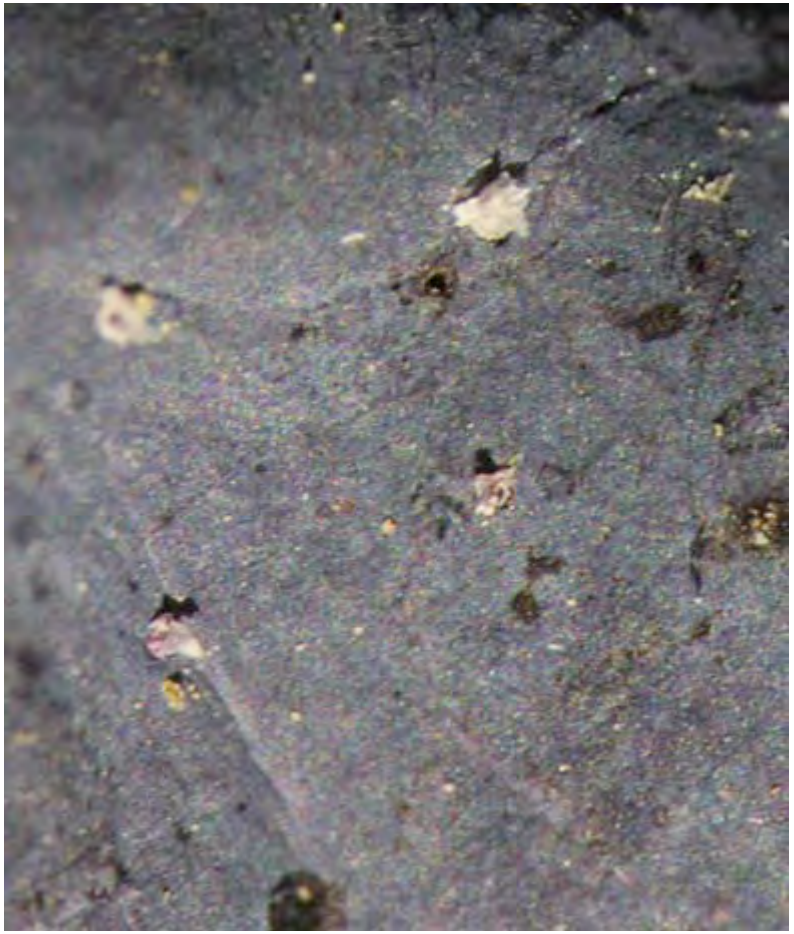
Injury to the berries



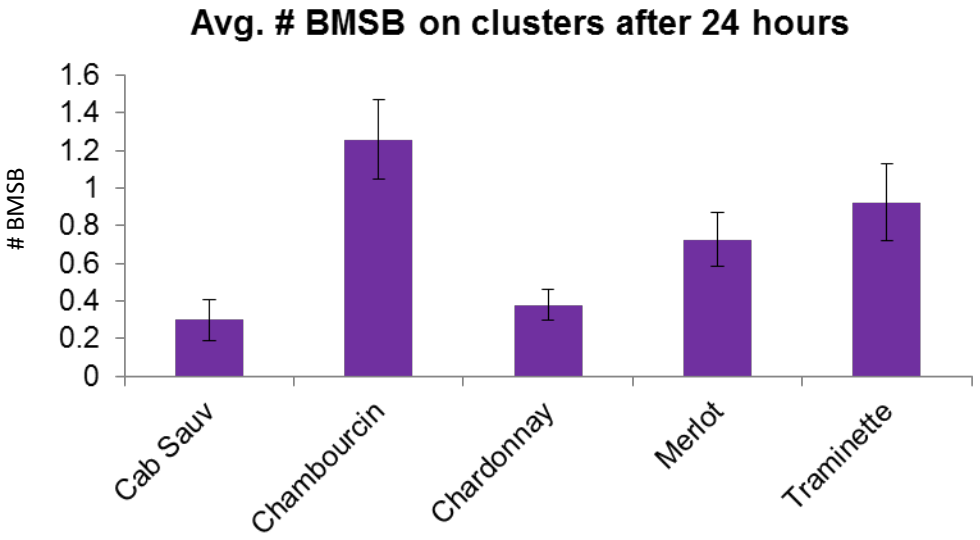


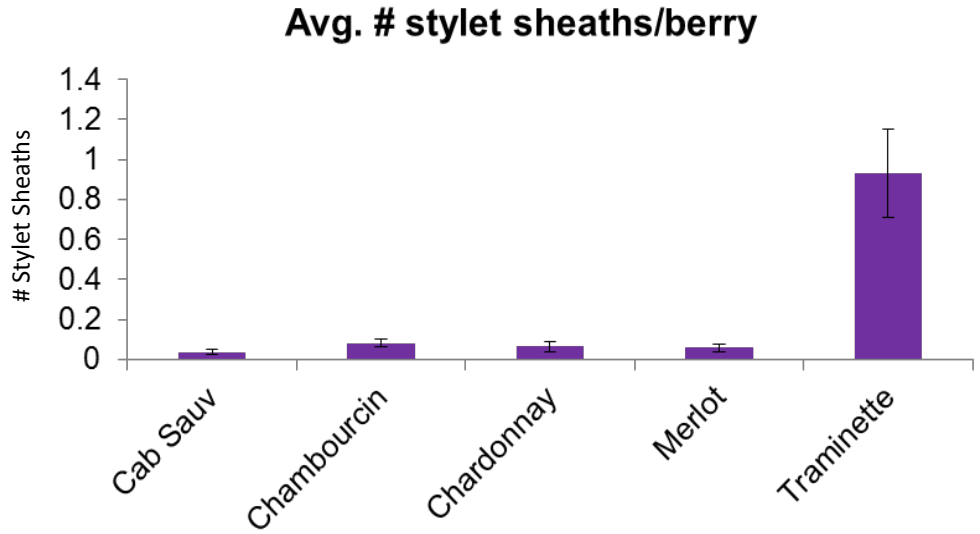

Presence of stylet sheaths



Photo’s, Chris Hedstrom

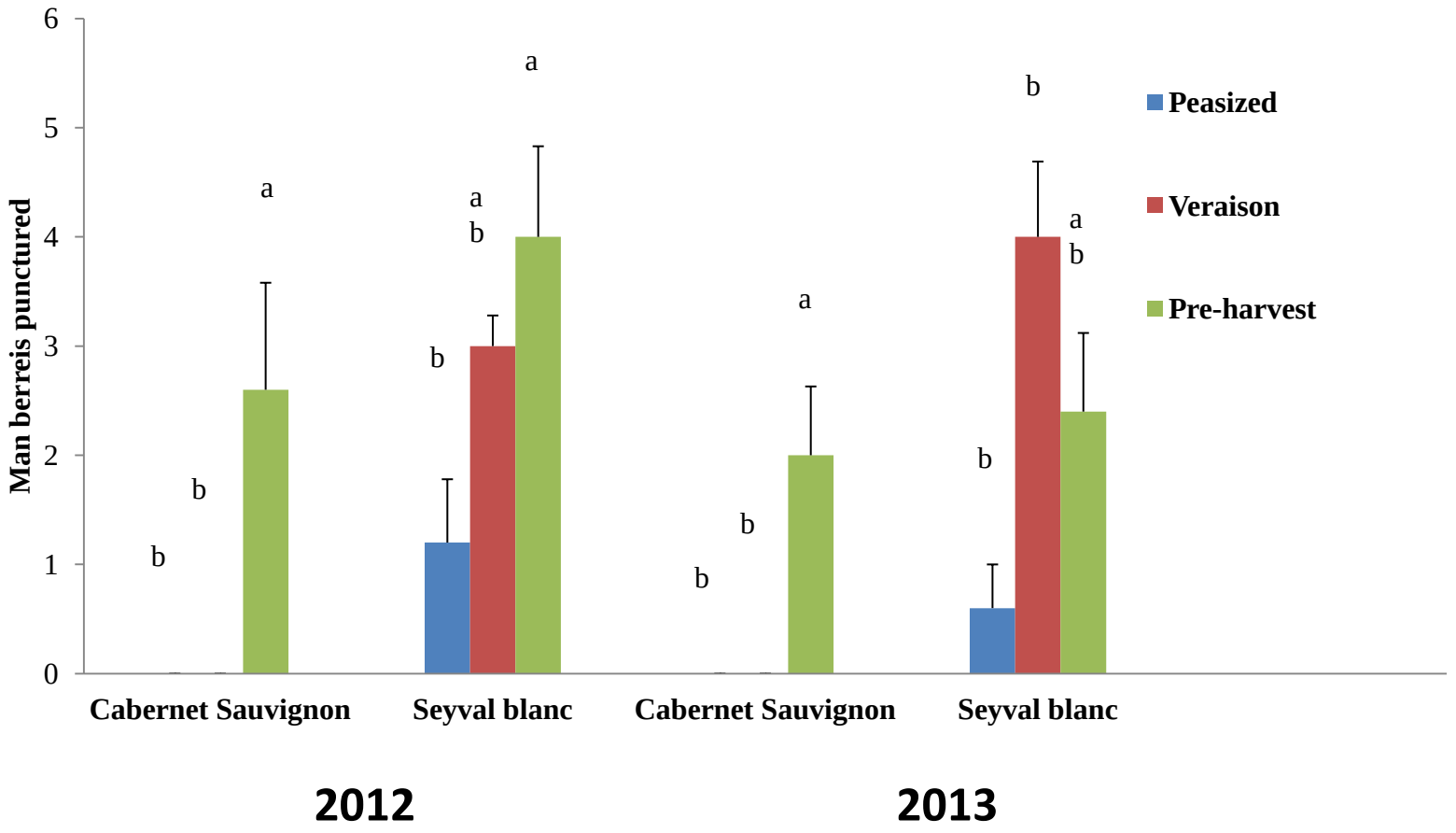
BMSB Lab Surveys & Choice Tests





- Significantly more BMSB seen on Chambourcin, Merlot, and Traminette
- Significant difference in stylet sheaths by variety
- Presence doesn't indicate feeding

Growth stage and varietal damage



Developmental stages

2012: $F = 5.30$; df = 2,2; $P < 0.05$, 2013: $F = 5.07$; df = 2, 2; $P < 0.05$;

Variety

2012: $F = 8.08$; df = 1, 1; $P < 0.05$, 2013: $F = 9.54$; df = 2, 2; $P < 0.05$

BMSB Controlled exposure studies

- Chardonnay and Traminette had higher damage than Chambourcin and Cabernet Sauvignon
- Grapes most susceptible to damage once veraison begins
- Majority of damage as aborted berries (up to mean 54%) and necrosis
- Both adult and nymph BMSB capable of causing damage at low abundance - 2/cluster
- Increasing amounts of sour rot with BMSB feeding density
  - Especially prevalent in Traminette and Chardonnay


Photo, Walton

Controlled BMSB Exposure 2012, 2013

- Treatments: 0 BMSB = Control
  1 BMSB = Low
  2 BMSB = High
- Three distinct exposure periods:
  Pea size (Jul 23, 2012; Jul 15, 2013),
  Véraison (Aug 25, 2012; Aug 4, 2013)
  Pre-harvest (Sept, 28 2012; Sept 15, 2013)
- Clusters exposed to BMSB for 7 days, sleeve feeding
- Analyzed using ANOVA and Tukey's HSD to separate means

Determination of direct impact:

C*rop quality* most important

Crop quality

- Mean cluster weight
- Mean number of berries per cluster
- Mean weight of berries

- Mean number of dropped berries at harvest.
- Mean number of BMSB punctures per cluster.
- Mean number of discolored berries per cluster.
- Mean number of raisin berries per cluster.

2012 Crop Year, Pinot noir

Treatment	Berries/cluster	Punctures	N
Pea stage	73.6±5.5 a	2.7±1.1 b	18
Veriason	70.9±4.6 a	6±4.8 a	21
Pre harvest	79.9±5.5 a	3.4±1.6 ab	20
Control	80.1±5.4 a	0.3±0.2 b	10

2013 Crop year, Pinot noir

Treatment	Berries/cluster	Punctures	N
Pea stage 1/Cluster	102.9±6 a	0.2±0.1 a	15
PS 2/Clus	107.4±6.7 a	1.1±0.5 a	15
Veriason 1/Cluster	97.7±6.7 a	0.2±0.1 a	15
Ver 2/Clus	108.6±9 a	0 b	13
Pre harvest 1/Clus	100.6±7.8 a	0.1±0.1 a	15
PH 2/Clus	93±8.5 a	0.7±0.4 a	15
Control	94.6±7.5 a	0 b	15

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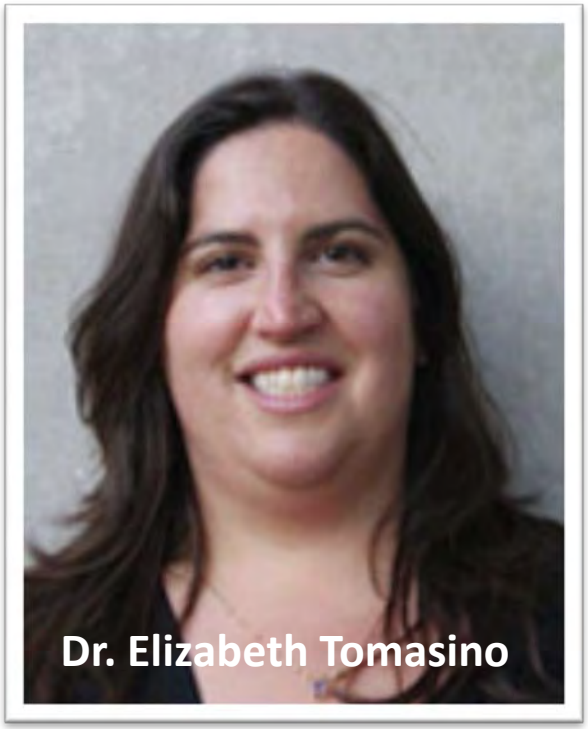
Stink bug impacts on grapes

- **Contamination (defensive volatiles):**
  - Physical: bugs clinging to clusters at harvest. Mechanical harvest increases contamination.
  - Chemical: excretion of defensive volatile chemicals can contaminate fruit, juice, and wine?
    - Harvest, packing, handling can trigger release

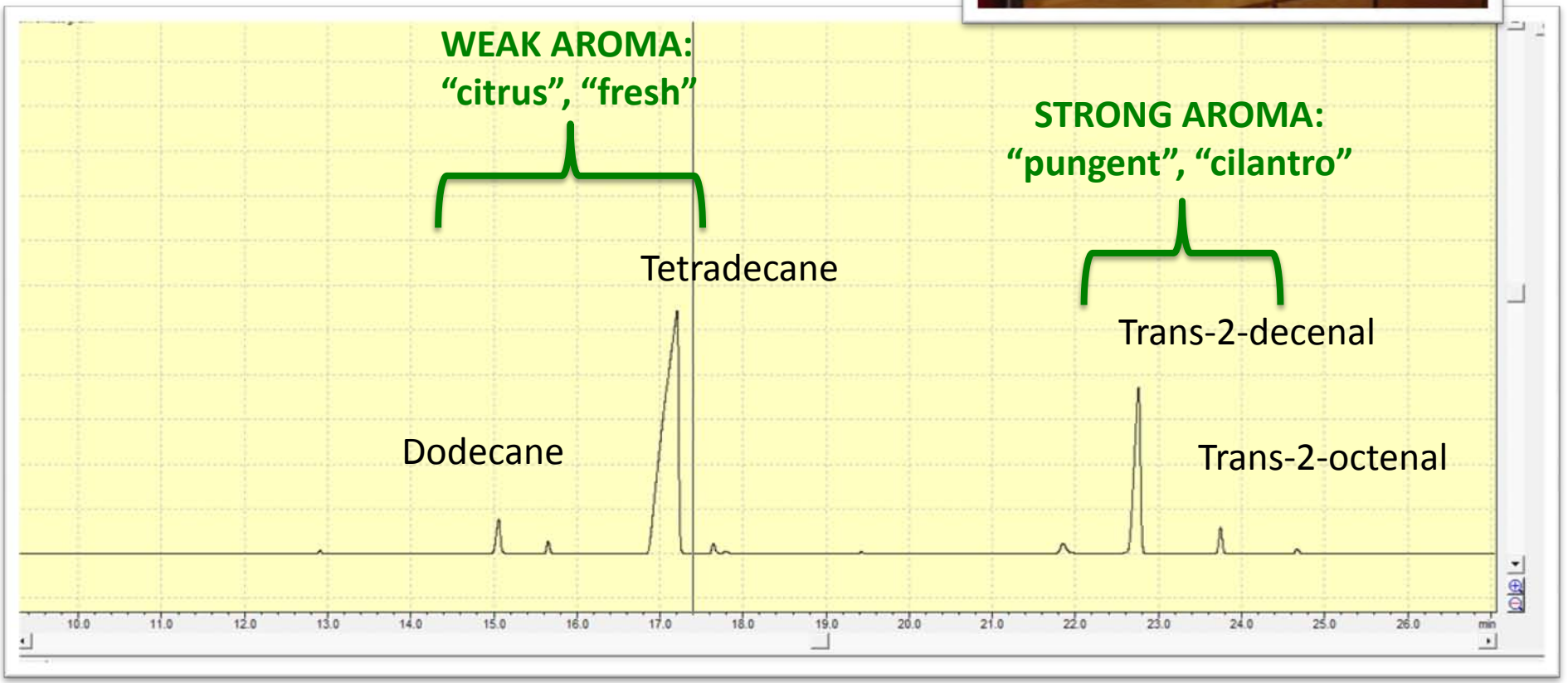
= taint

Impacts are poorly understood, no damage thresholds



- New OSU faculty with wine sensory analysis and flavor chemistry expertise
- **Research question**: will BMSB contamination result in wine taint?
  - High quality Pinot Noir
  - Donated by **Adelsheim Vineyard**

- **Step 1**: Characterize BMSB defensive compounds
- GCMS chromatogram of the volatile aroma compounds excreted by “stressed” BMSB



Treatments

Photo, Wiman

- **Stinkbugs added to Pinot noir grapes before wine processing**
- **Taint in destemmer**
- **Taint in pressing (dead and some alive)**
- **Treatments:**
  - **Control – no bugs**
  - **(T1) – 1 bug per 4 clusters**
  - **(T2) – 1 bug per 2 clusters**

Fairly high densities, but not entirely unreasonable considering potential BMSB densities

Taint in destemming

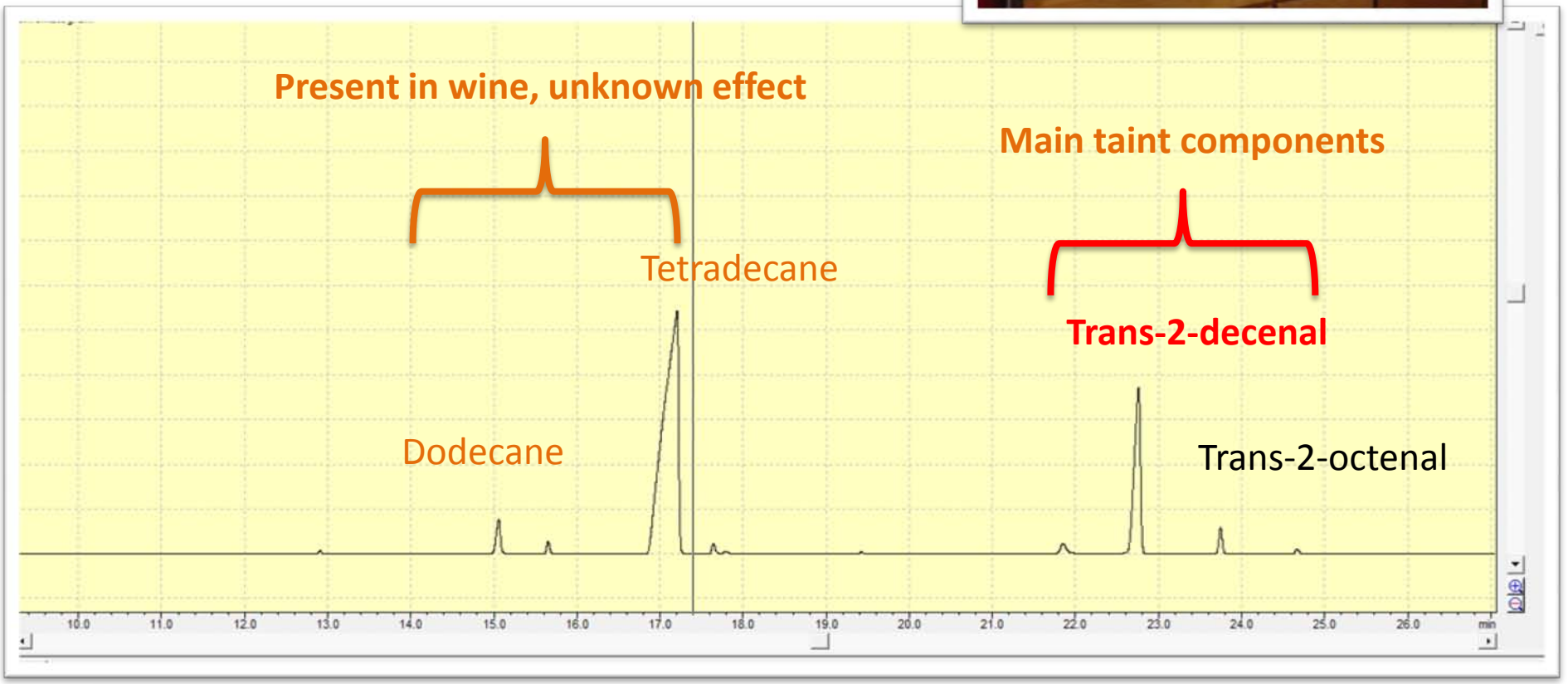
We found BMSB surviving destemming process

Cold soak process containing bugs

Taint compounds released again during pressing, despite majority dead bug presence

What made it into finished wine?

- GCMS chromatogram of the finished wine (and at fermentation intervals).



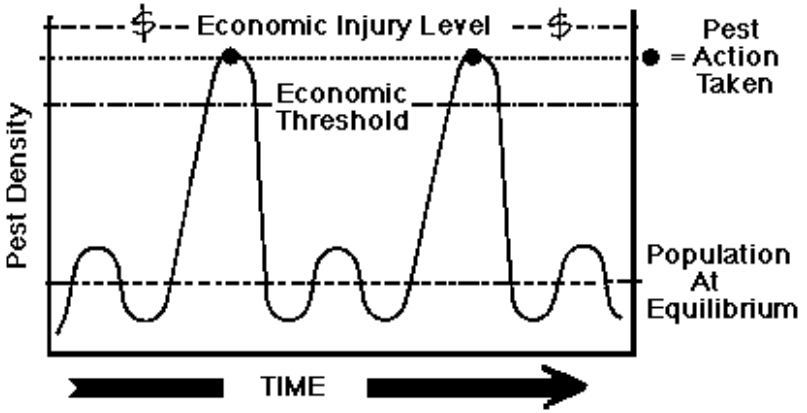
Sensory Panel Evaluation

A) Difference testing (triangle tests) showed that consumers could tell a difference between the treatment wines and the control (significant at $\alpha = 0.05$)

B) Consumer rejection threshold found to be very close to the detection threshold, even even low amounts of BMSB taint have a negative impact on Pinot noir quality.

Conclusions on wine taint

- **BMSB taint is real!** Other processes and varieties may change the results.
  - Masked fruity characteristics of the wine
  - Contrasts with results from MD
- **Consumer rejection:** as soon as it's detectable, it's rejectable
  - Opportunity to link detection thresholds in wine to density of insects in the field
  - This may become the **treatment threshold** for vineyard managers



Will chemistry have a solution?

Nuisance factor