

# Pysyllids and the Guava Effect

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# HLB/Greening

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- Huanglongbing = yellow shoot
- Originated in SE Asia/India/Africa
- infected trees produce small, misshapened fruit
- infection spread by Asian Citrus Psyllid
- trees decline and die in a few years
- there is currently no cure





photo: Jamie Yates





photo: Jamie Yates



photo : Michael Rogers

*Citrus interplanted with guava in Vietnam has repelled citrus greening disease.  
The potential cure could come at a heavy cost — guava is a favorite  
for Caribbean fruit flies, and many guava trees may be needed.*

## Greening — the guava cure

By Kevin Bouffard

Little more than a year after U.S. Department of Agriculture researchers confirmed Florida's first case of citrus greening, USDA

exciting," Arnold said in a Dec. 15 telephone press conference.

USDA researchers have begun testing whether the "Southeast Asian Guava Effect" (SAGE) will work in Florida. Tim Gottwald, a plant

Gottwald said naturally occurring volatile compounds in guava might be the key to its effectiveness.

"Apparently these volatiles are confusing or repelling in some way the insects," Gottwald said. Guava trees also seem to be effective in repelling

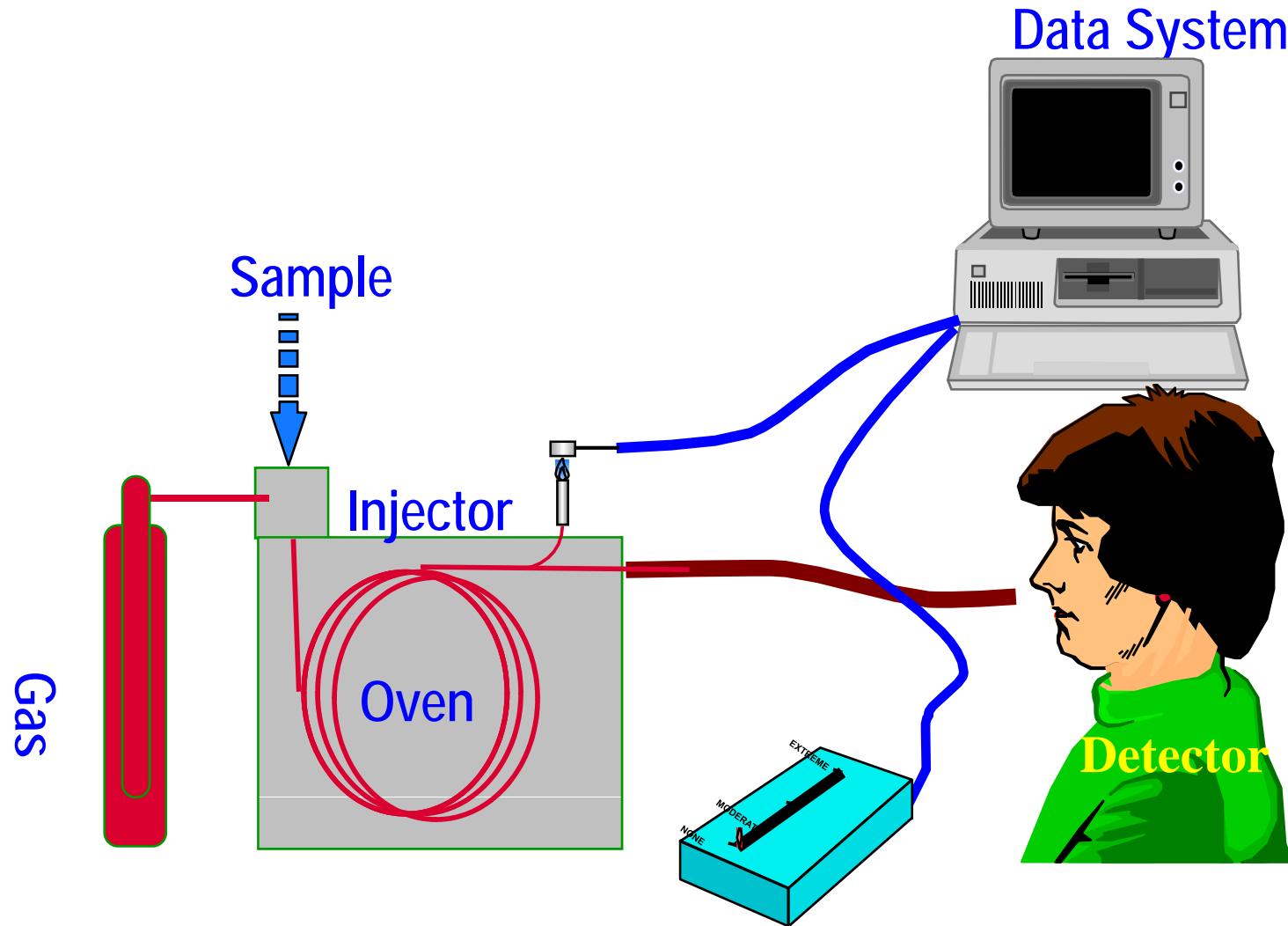
*Citrus Industry, February 2007*

# Objectives

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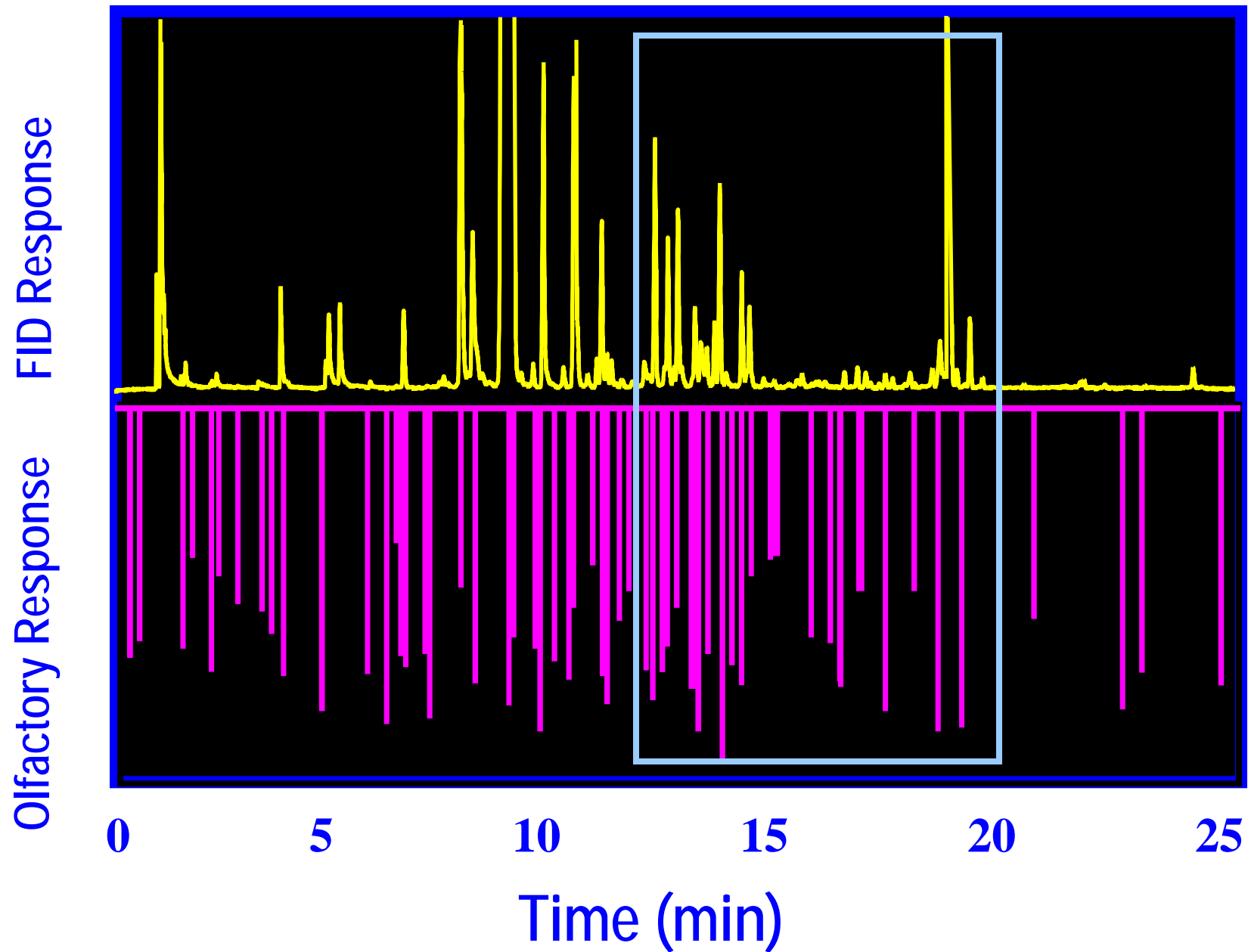
- Identify the active components (volatiles) in guava leaves that repel or reduce psyllid populations and avoid the negative aspects of guava trees/fruit.
- Develop controlled release device for delivery of repellent chemicals in the field
- **Practical application of this research:**  
*Develop effective repellent to protect citrus from psyllid infestation*

# Human Aroma Assessors

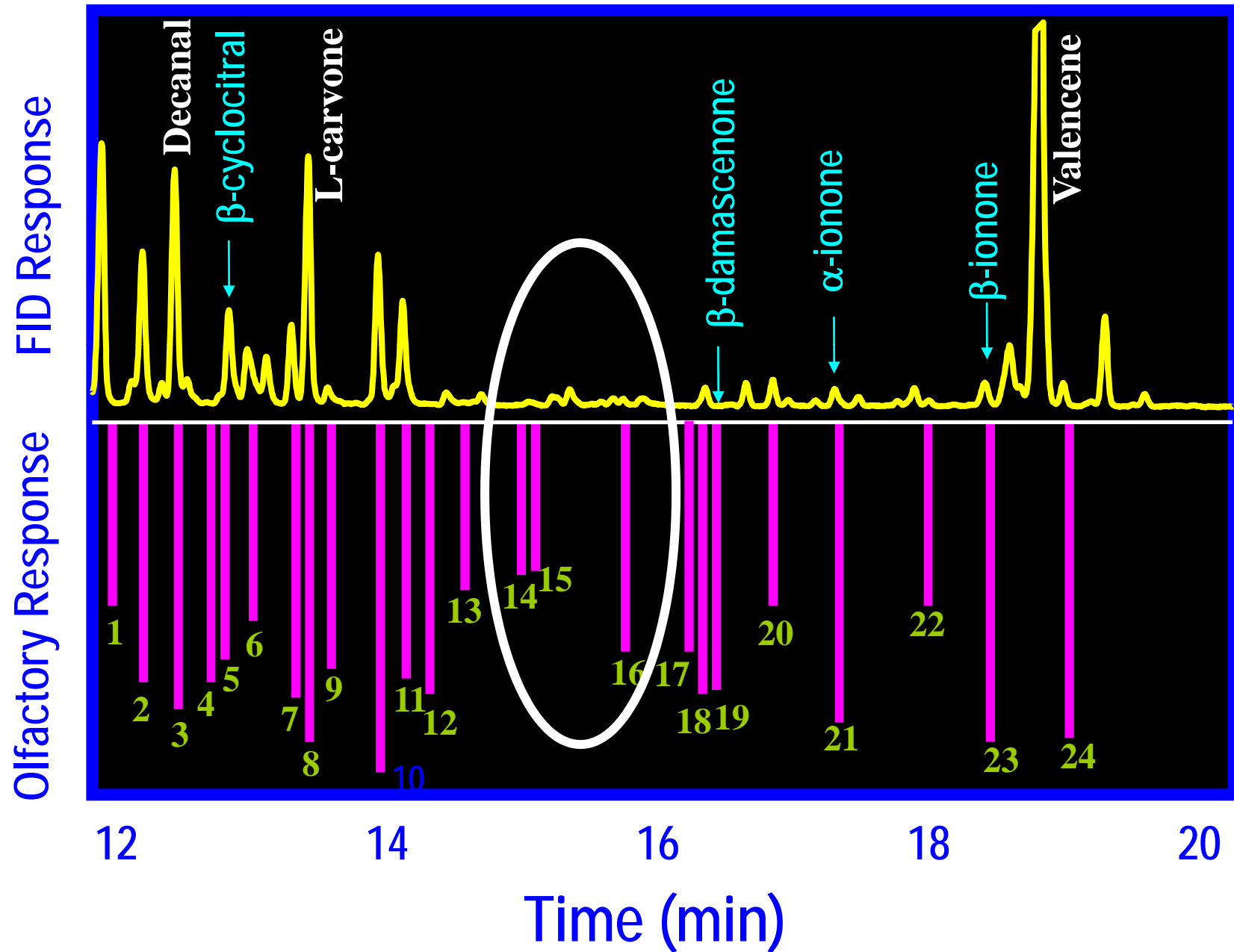




# Aroma active compounds in Orange Juice



# Norisoprenoids in Orange Juice



# Initial Reasoning

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- Active guava volatile non obvious
- Must be from leaf not fruit
- Must be found in guava not citrus
- Sulfur volatiles biologically active



# Biologically Active Sulfur Compounds



neem seeds (*Azadirachta indica*).

● Balandrin, M. F.; Lee, S. M.; Klocke, J. A., *Biologically active volatile organosulfur compounds from seeds of the neem tree J. Agric. Food Chem.* **1988**, 36, (5), 1048-54.

● di-n-propyl disulfide, which is larvicidal to *Aedes aegypti* (L.) (Diptera: Culicidae) (yellow fever mosquito)

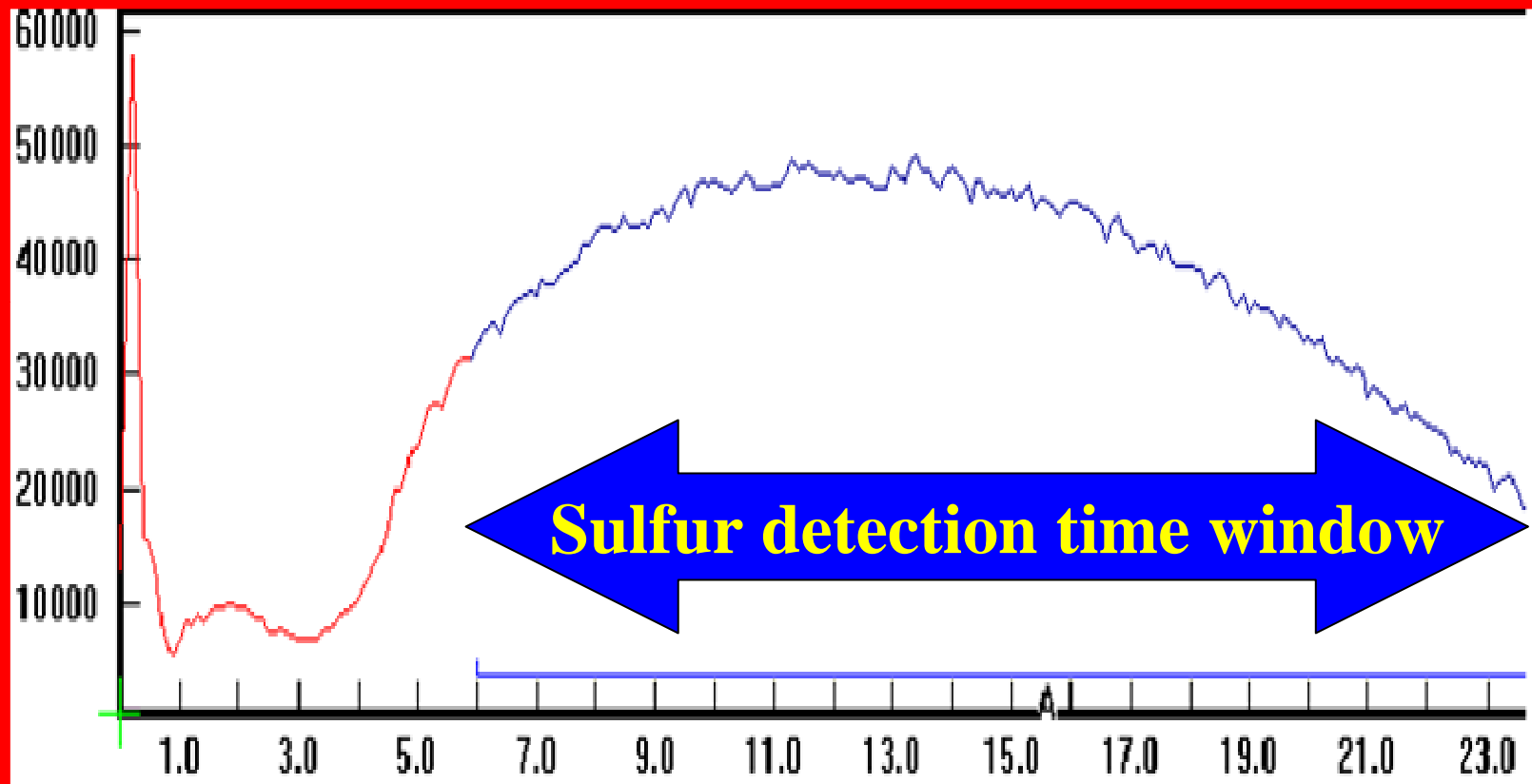
# Plants Produce Defensive Volatiles



● Dugravot, S.; Mondy, N.; Mandon, N.; Thibout, E., Increased sulfur precursors and volatiles production by the leek *Allium porrum* in response to specialist insect attack. *J. Chem. Ecol.* **2005**, 31, (6), 1299-1314.

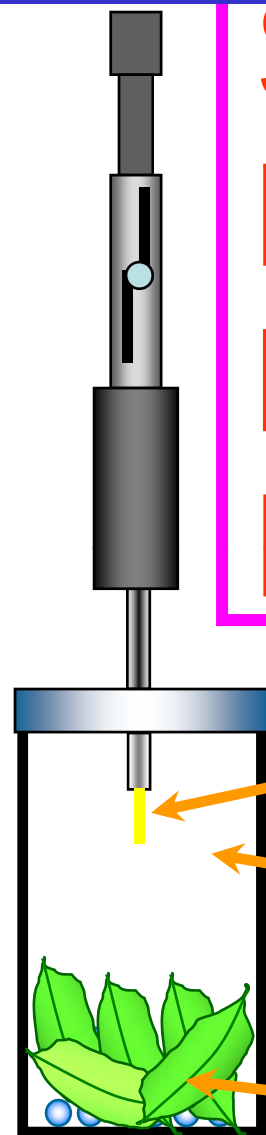
- dipropyl disulfide
- propyl propenyl disulfide

# Pulsed Flame Photometric Detection





# Solid Phase Micro Extraction



**Coated Silica Fiber**

**Headspace**

**Leaves**

# Samples

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- Leaf flushes from:
  - 'white guava' (*P. guajava* L.; Myrtaceae)
  - Valencia and Hamlin sweet orange (*Citrus sinensis* L. Rutaceae),
  - Ray Ruby grapefruit (*C. paradisi* Macf.)
  - rough lemon (*Citrus limon* Burm.)
- Sample size approx. 3.5g

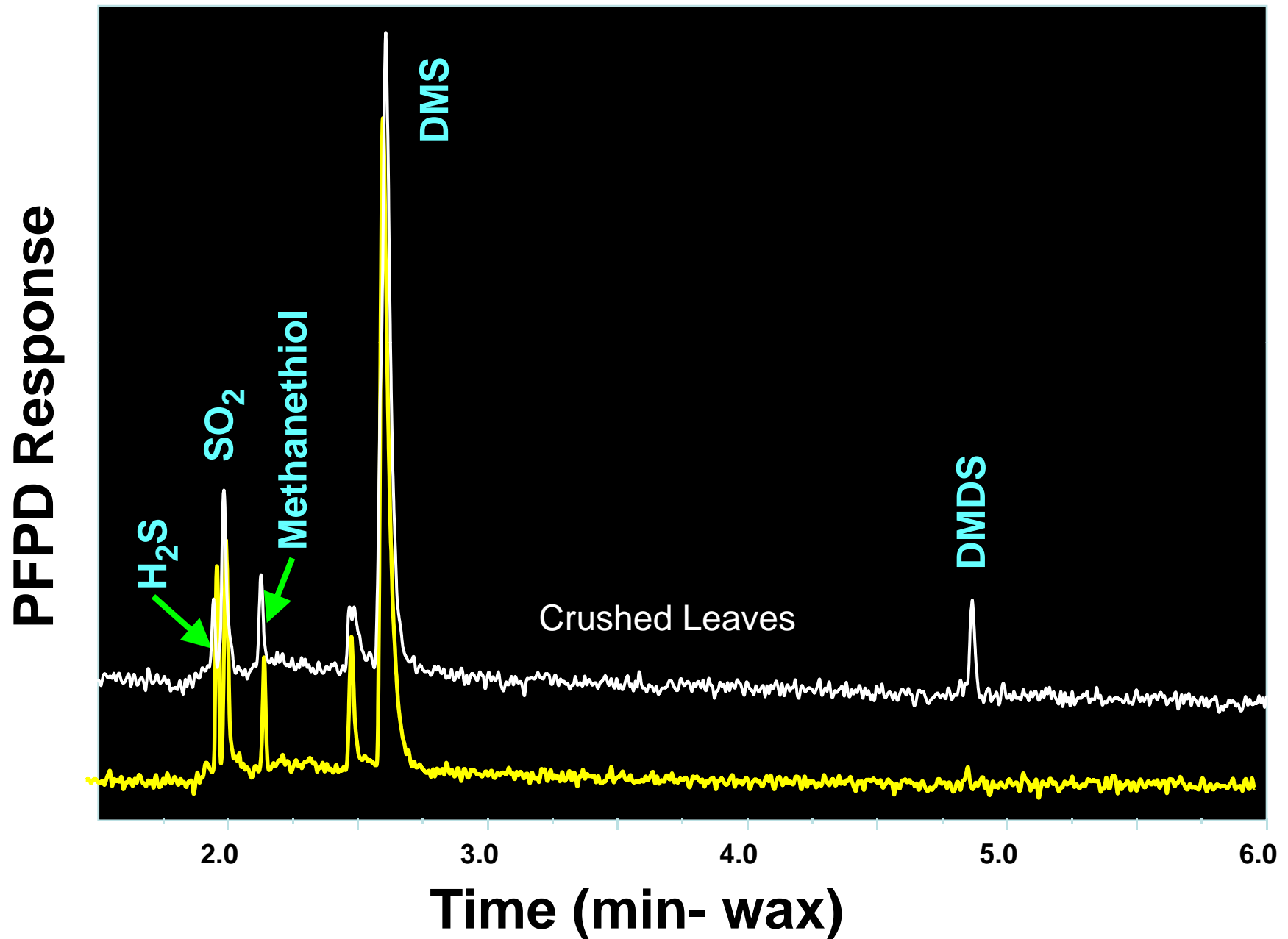
# Volatile Collection

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- SPME Headspace Technique
- Sample equilibrated at room temperature for 30 min.
- Fiber exposed for 1 or 15 min.
- retracted and inserted into GC injector



# Guava Leaf Sulfur Volatiles



# Guava vs Citrus

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- Both Produce similar uncrushed sulfur chromatograms
- Only Guava produces DMDS

SPME 1cm RT 30 min equil 1min exp

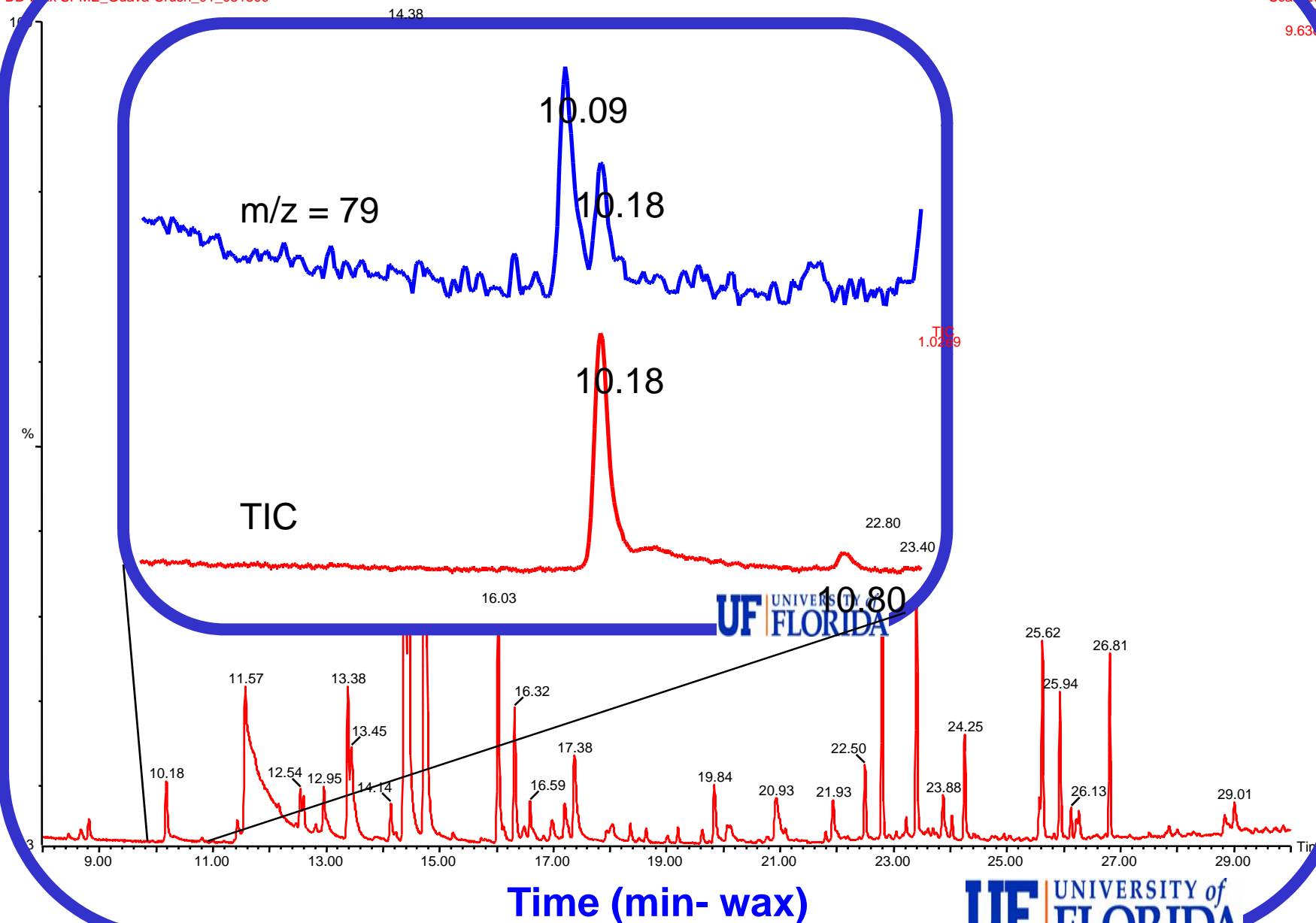
DB WAX SPME\_Guava-Crush\_01\_051509

Restek Stabilwax column 40-240@7°, 15-May-2008 + 15:35:49

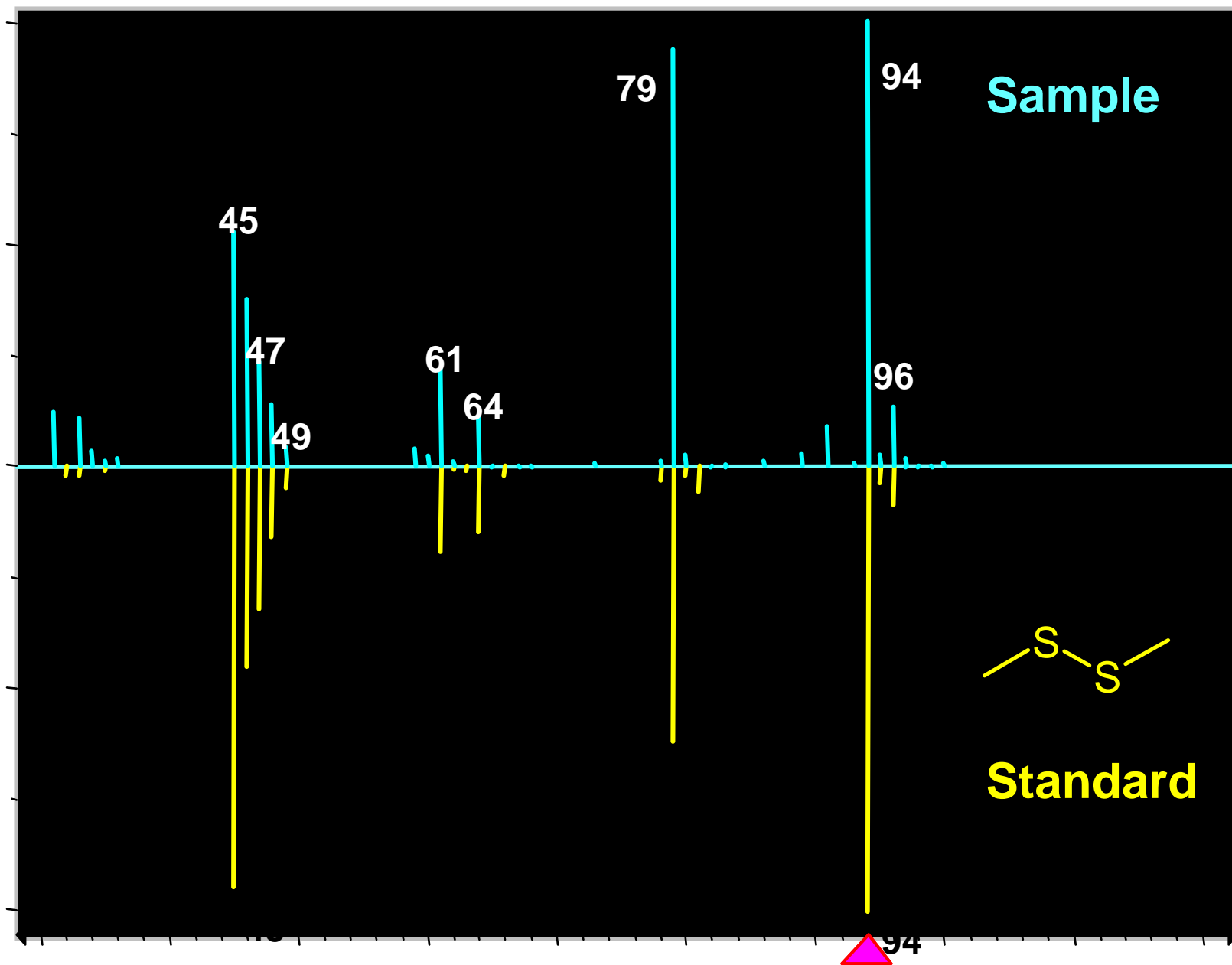
Scale: EI+

TIC

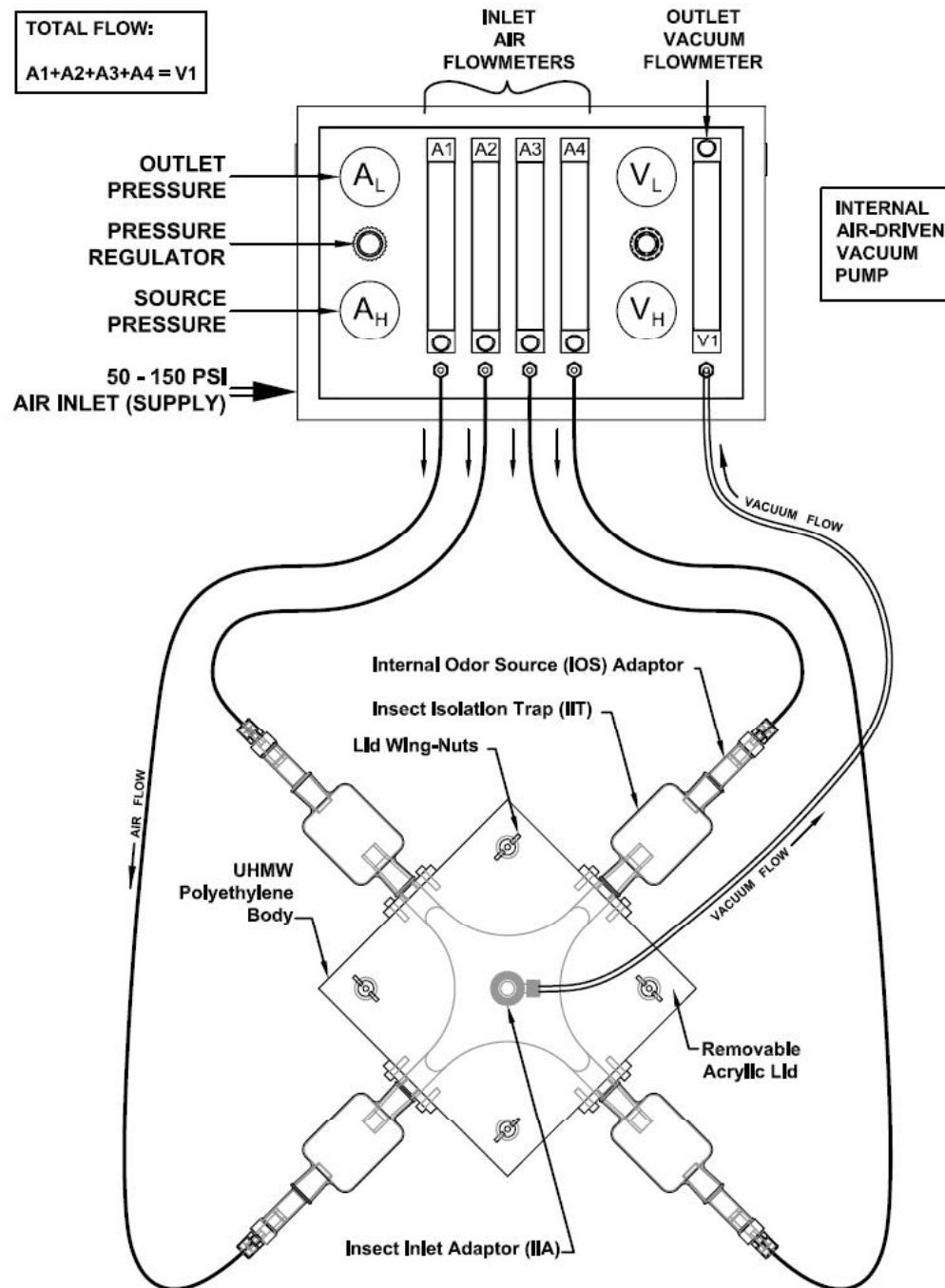
9.63



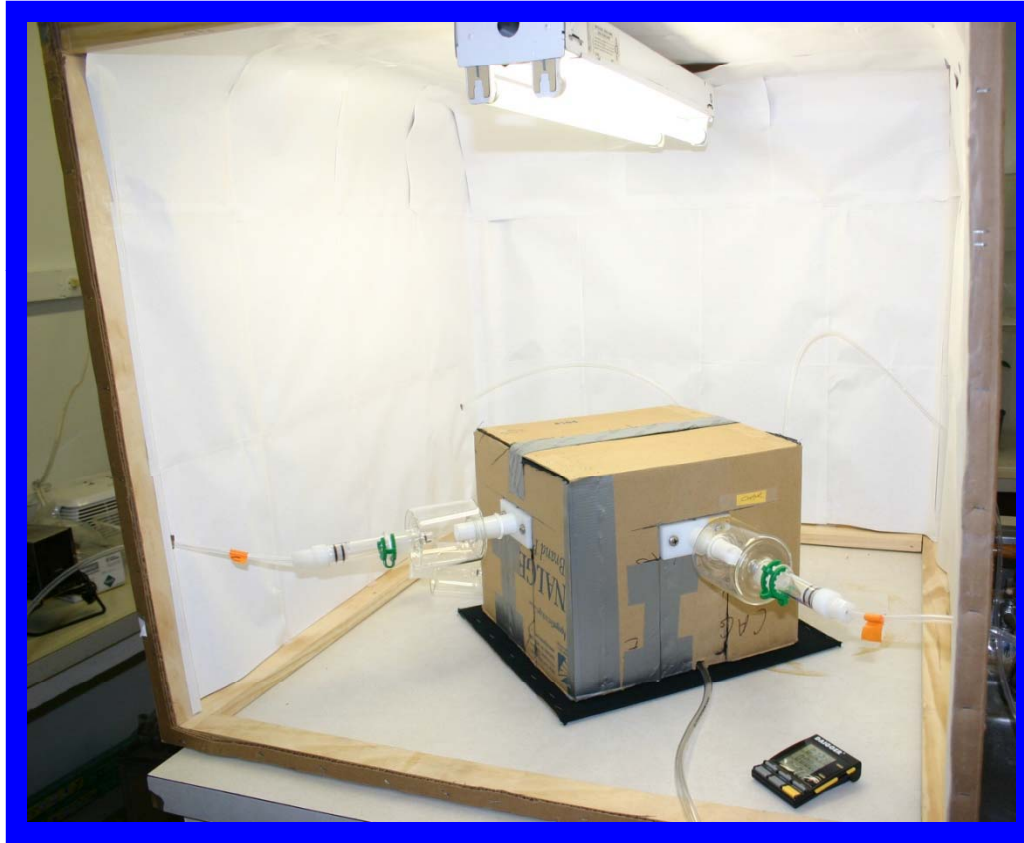




# 4-CHOICE OLFACTOMETER - Complete System Diagram

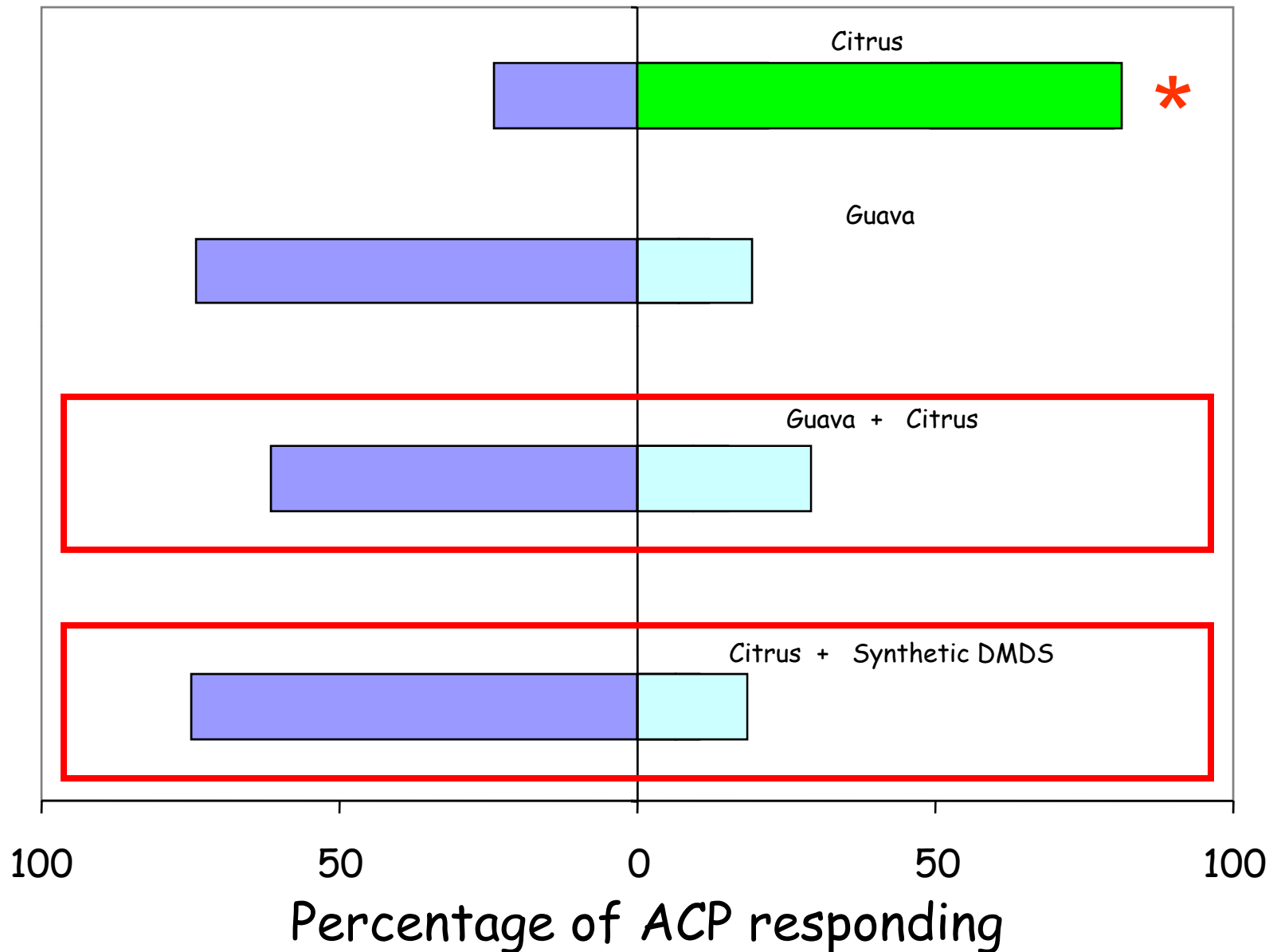


# Behavioral analyses in the lab



Proportion of ACP  
not entering chamber  
with source of volatiles

Proportion of ACP attracted  
to chamber with citrus





## Biodegradable wax-based controlled-release system



# Conclusions

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- Guava leaves produce DMDS when mechanically injured.
- DMDS is highly toxic to most insect species
- It is one possible explanation for the repulsive effect of guava on the Asian Citrus Psyllid

# Conclusions

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- Guava repels ACP response to citrus host plants confirmed
- The synthetic compound dimethyl disulfide (DMDS) identified from Guava repels ACP in the laboratory equally to authentic Guava volatiles
- Field trials planned for 2009

# Acknowledgements

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# Questions?