Winter Moth

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NPDN
National Plant Diagnostic Network

Winter Moth

Operophtera brumata

European insect, accidentally imported

- Nova Scotia - 1930s
- Pacific Northwest - 1970s
- Eastern MA - 1990s
- RI, CT – 2000s

Winter Moth

Operophtera brumata

Hosts: maple, oak, crabapple, apple, cherry, basswood, ash, white elm, linden, viburnum, blueberry, spruce, rhododendron

Winter moth adults

Pictures Bob Childs, UMass

- Moths emerge from ground
  Thanksgiving - Christmas
- Females climb up & deposit eggs in bark nooks and crannies

Early spring, eggs hatch. Caterpillars wriggle into buds

Monitor egg hatch

November set up tree bands

Shelter Tree
North Attleboro, MA

Tree banding workshop with BugBarrier

Bugbarrier

- Shelter Tree, North Attleboro
- Maybe just wrap batting around trunks
- Expensive
  - 10 ft. $37
  - 30 ft. $88
  - 250 ft. $590

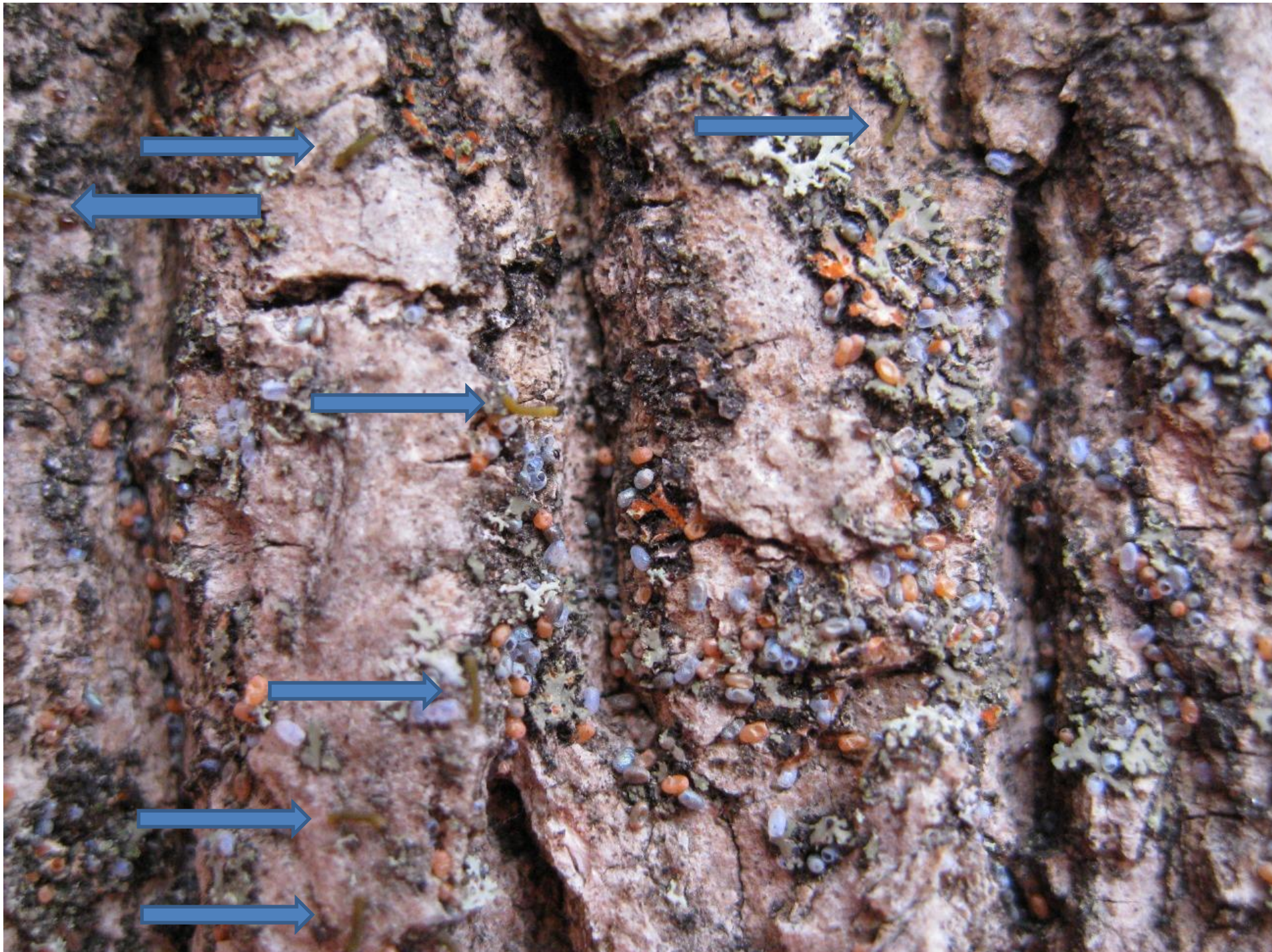
Remove band in March before egg hatch


Eggs congregated below band

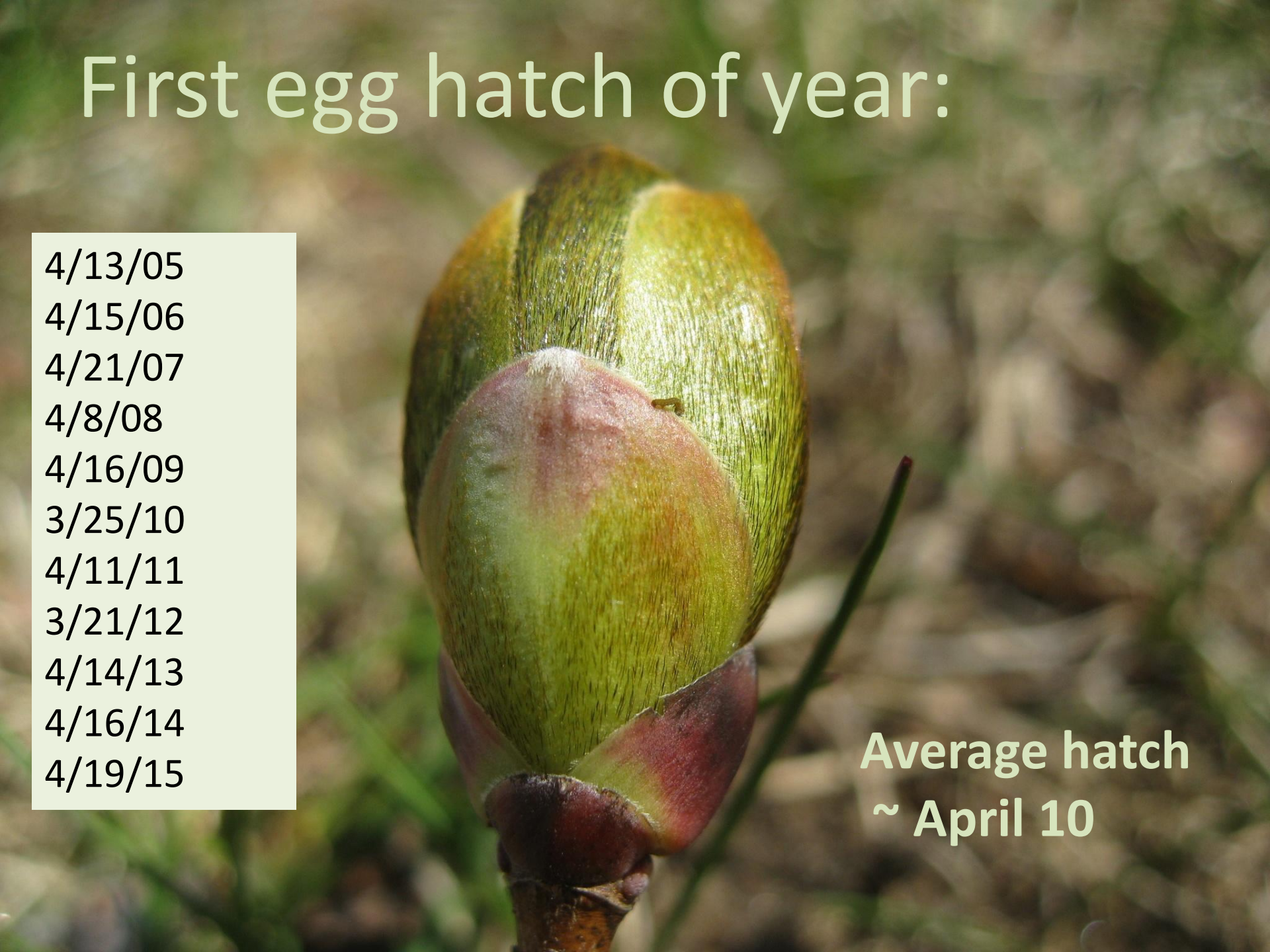
How to see the eggs…


Eggs turn blue ~2 days before hatching


All eggs hatch ~ 8 days



First egg hatch of year:



4/13/05
4/15/06
4/21/07
4/8/08
4/16/09
3/25/10
4/11/11
3/21/12
4/14/13
4/16/14
4/19/15

Average hatch ~ April 10

Growing Degree Days (GDD)

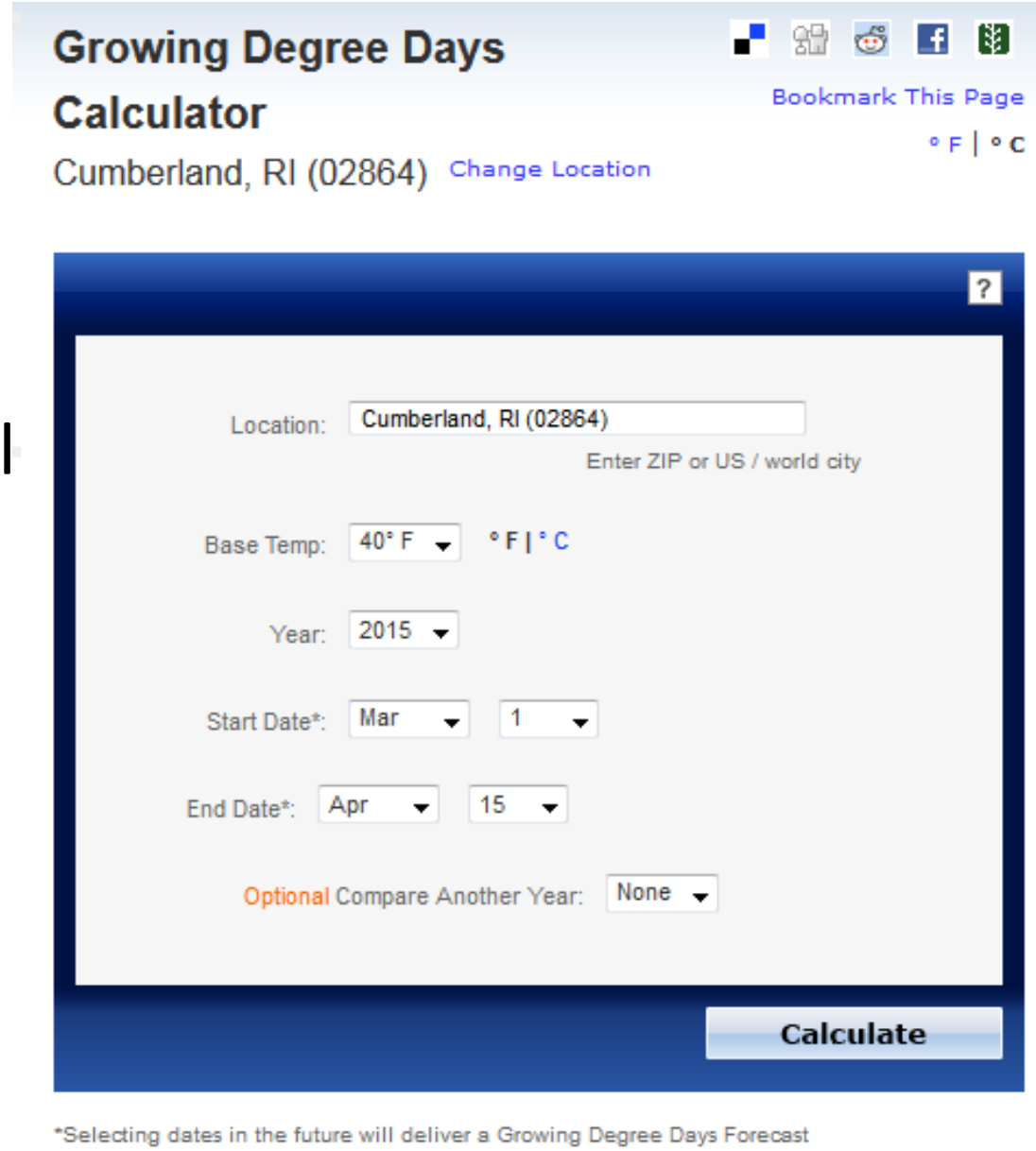
- Measure of heat accumulation
- Plants/animals develop above some minimum temperature
- Winter moth eggs don’t develop <40°
- Above 40° eggs advance

Calculate GDD

- **Average 24 hour T ° – base T °**
- Average T° = T_{max} +T_{min}/2
- For winter moth use base 40°
  - Below 40° winter moth eggs don't develop
  - (Default Base 50 ° not a good base for winter moth)
- If minimum goes below base, use T_{base} for min.
- GDD=Tmax +Tmin/2 – Tbase

Can also follow GDD

The Weather Channel



- http://www.yourweekendview.com/outlook/agriculture/growing-degree-days/

?

Growing Degree Days (GDD) for Cumberland, RI

Mar. 1 - Apr. 15

2015 = 102.5 GDD

Average = 77.0** GDD

Location: Cumberland, RI (02864)

Enter ZIP or US / world city

Base Temp: 40° F ° F | ° C

Year: 2015

Start Date*: Mar 1

End Date*: Apr 15

Optional Compare Another Year: None

Calculate

Kingston, RI 1st hatch dates

- 4/19/15 154 GDD
- 4/16/14 180 GDD
- 4/14/13 120 GDD
- 3/21/12 147 GDD

Can accumulate lots of GDD quickly. April 15, 2015 Kingston had 109 GDD

GDD models give a range

Green fruitworm	51–151
Pear psylla	31–99
Redbanded leafroller	112–178
Green apple aphid	127–297

Someone needs to do real research for winter moth, but this may not be so helpful. Best is to monitor. Timing is too critical with winter moth.

11 days after eggs start hatching

Spray when eggs start hatching

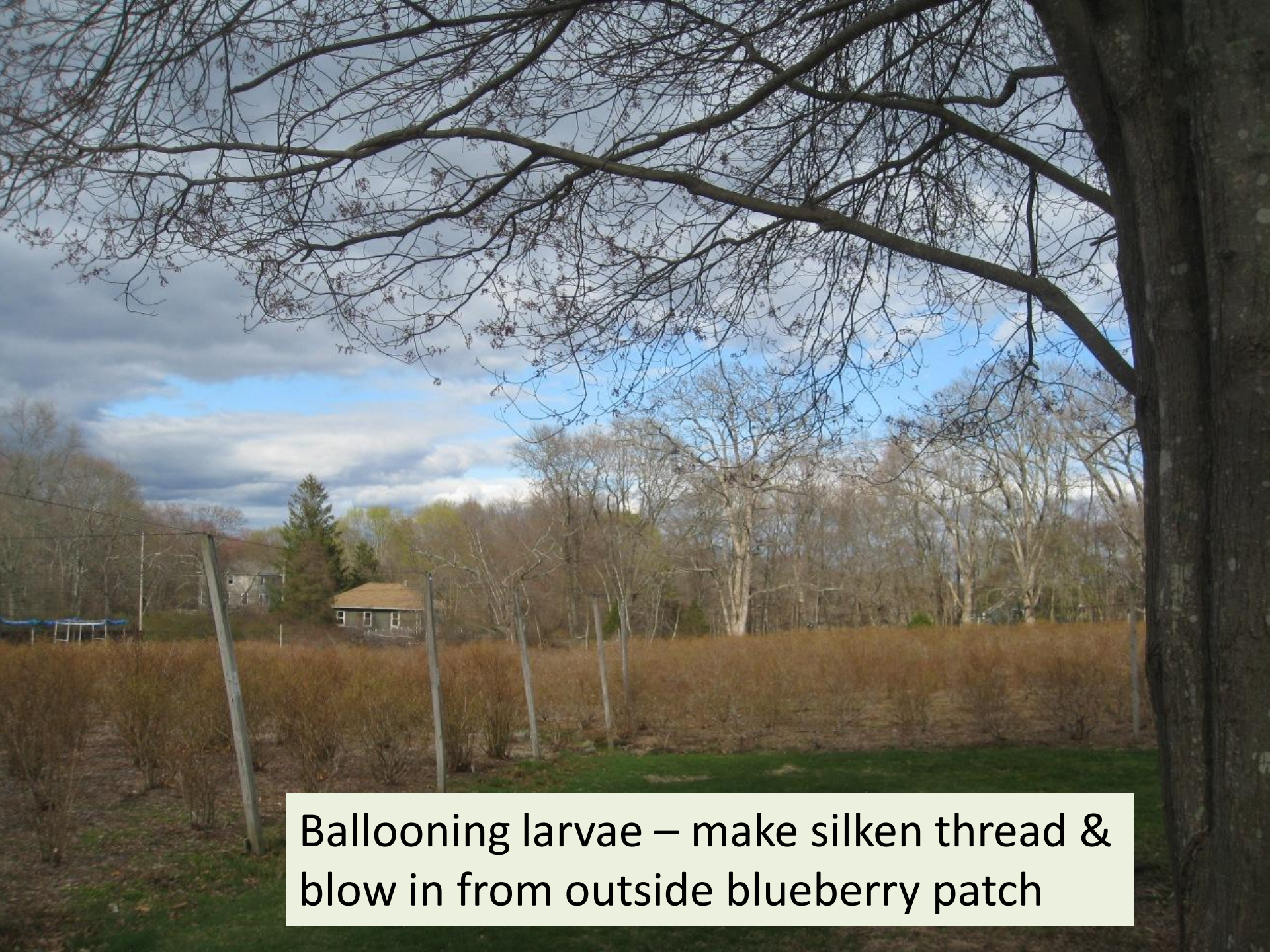
- Stop caterpillars from entering buds
- Imidan works well
- Perhaps Sevin, Malathion, Delegate fine
- Entrust (OMRI spinosad) fair
- Bt won't work until caterpillars feed

- If heavy rain before all eggs hatch, spray again, otherwise wait to spray again.

Additional sprays

- Don’t spray again until buds are open and caterpillars climbing around

- Caterpillars safe inside these buds….


Ballooning larvae – make silken thread &
blow in from outside blueberry patch

Caterpillars make silk


Larvae can continue to drop onto blueberries


Mature larvae drop to ground to pupate

Form pupae inside pupal cell

Parasitoid - *Cyzenis albicans*

Eggs are laid on surface of injured leaves

Photo: Thijs de Graaf

Caterpillars accidentally eat eggs

Collect larvae to check for parasitism

Late May

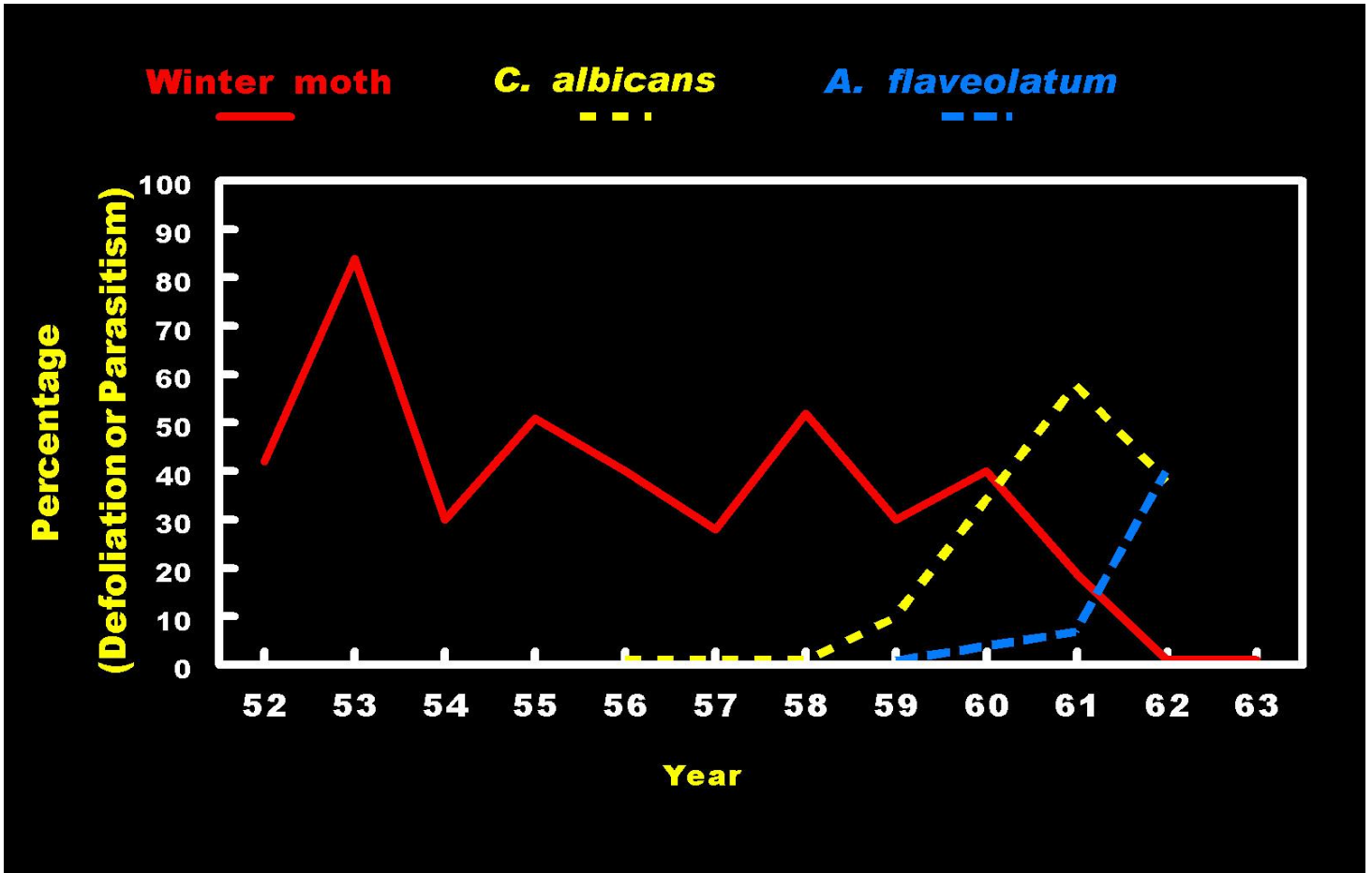
Winter moth biocontrol in Northeast

- Started releasing flies in 2006 in MA, 2011 RI
- 40 sites released and recovered flies at 17
- > 60% flies at several sites in Wellesley 2015
- Slowly but surely...

RI winter moth biocontrol releases

- 2011 – Goddard Park
- 2013 – Bristol, Jamestown
- 2014 – Kingston, Cumberland
- 2015 – Lincoln, Little Compton

- Nova Scotia - took 5 years to recover flies
  - And then 2 years to get high levels of parasitism
  - In MA, took 5 years to recover any flies…



Help is on the way, but may always need to control winter moth for great blueberry crop

Spotted wing Drosophila

Spotted wing Drosophila update

- No magic
- Early varieties mostly miss infestation
- Pick bushes clean as possible
- SWD infest bottom of bush first
- Good results with netting – Ugh!
- Interesting results with trap out

2013
URI – SWD & blueberry variety trial

- No insecticide applied
- Blueberries SWD-free until July 25 harvest

  Harvested June 27 - July 18 with no SWD in fruit
- **Earliblue, Bluetta & Collins – harvested SWD-free for 4 weeks**
- 75% infestation by August 1 harvest

URI 2013 & 2014 & 2015

2013 – Trap Out

Started out with dual baited trap then switched to flour & yeast

2014 - tried Trap Out again

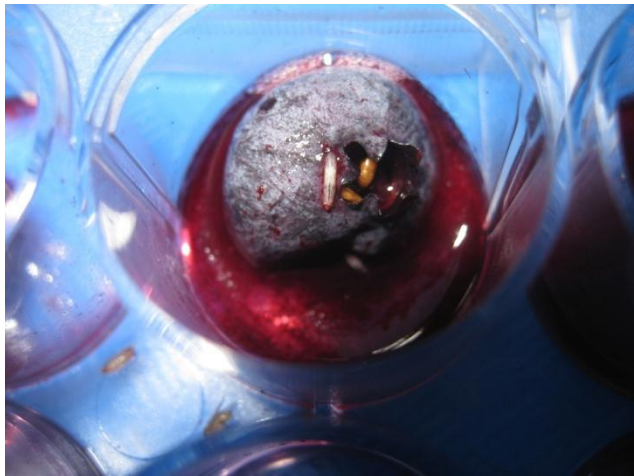
- Suzukii Trap bait
- Boric acid treated cups
- 2013 found more SWD in bushes with traps, 2014 same in both

2014
Berry position on bush

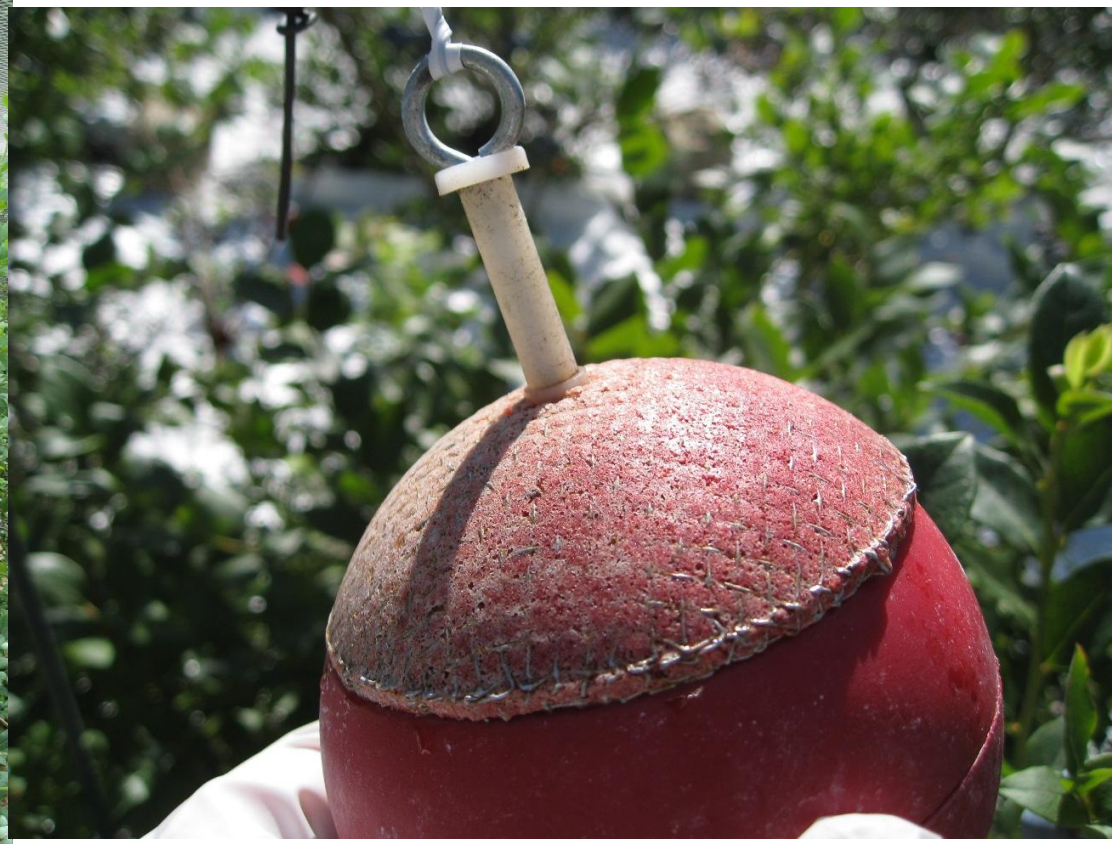
- Lower 10”-20”
- Middle 36”-46”
- Upper 58”-68”
- Collected 24 berries per position – 2 bushes per collection

2014
Where are SWD laying eggs?

Farm		Lower	Middle	Upper
		SWD	SWD	SWD
EF	7/23/14	0	0	0
EF	7/31/14	21	9	1
EF	8/7/14	96	46	43
SBF	8/19/14	32	22	10
RP	8/29/14	36	15	16



2015 – Pesticide Treated Spheres



Bluetta Control
1 7/13/15 25
Collins Control 2 7/13/15
Bluecrop Control 1 7/13/15
Northland Control
1 7/13/15 25
Bluejay Control 25 7/13/15
Bluetta Control
7/13/15 25 2
Bluecrop Control
7/13/15 2
25

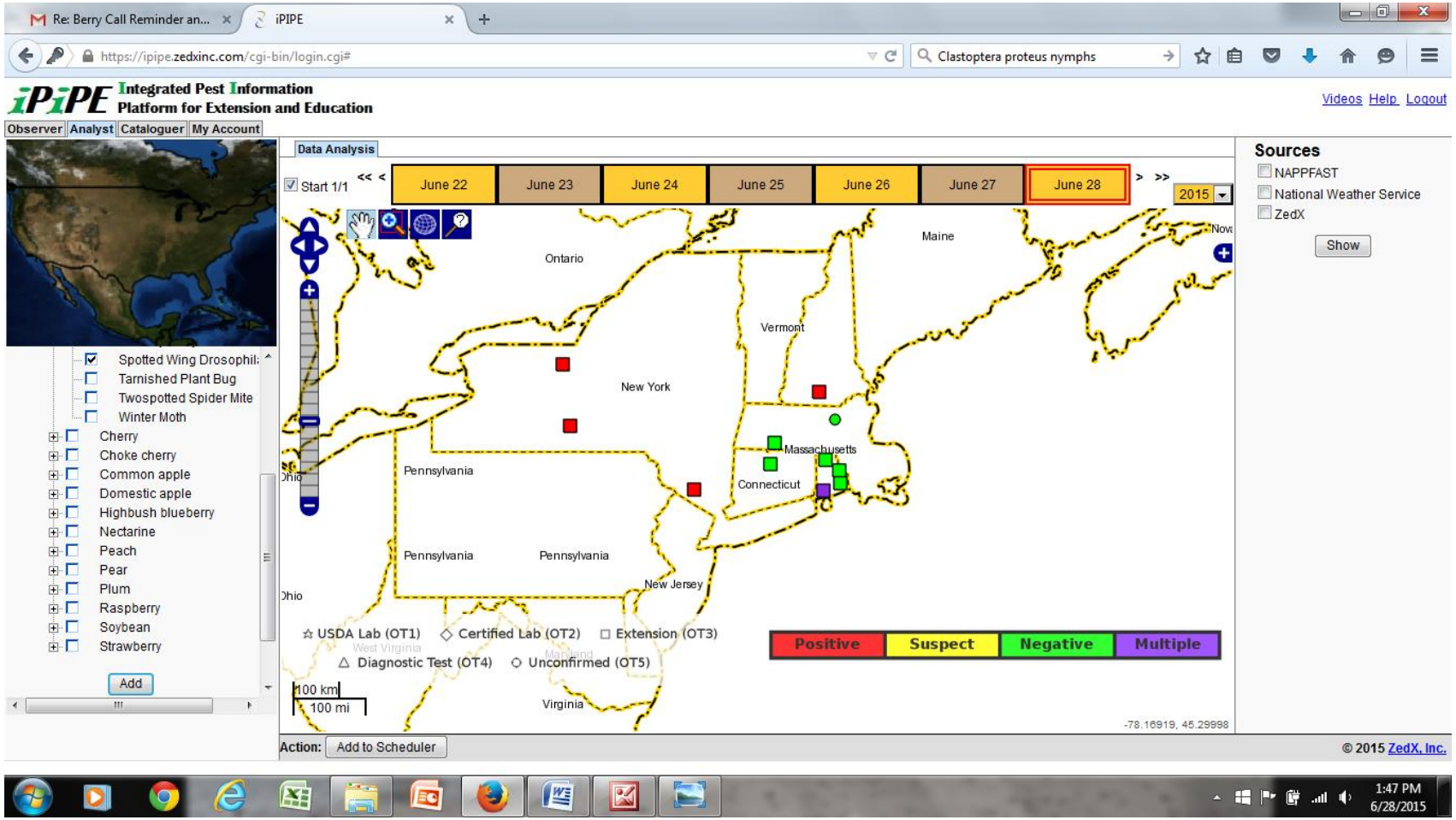
2015 SWD Research

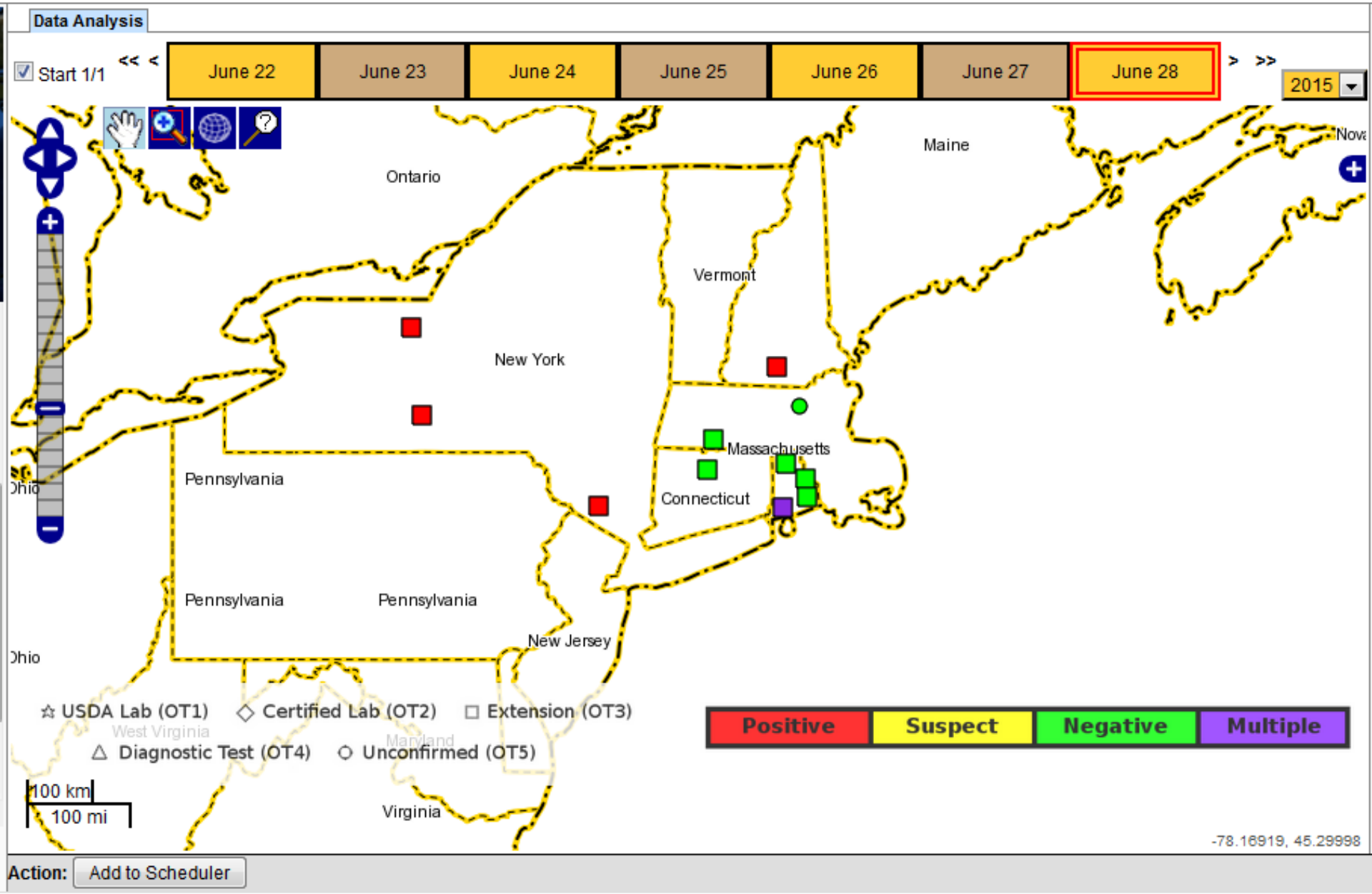
- PTS - maybe gives an additional week SWD-free (maybe not!)
- Cornell researcher looking at attract and kill with scent, not just visual attraction
  - Better results than with PTS
  - Placed near bottom of raspberry plants plus above plants

iPiPE

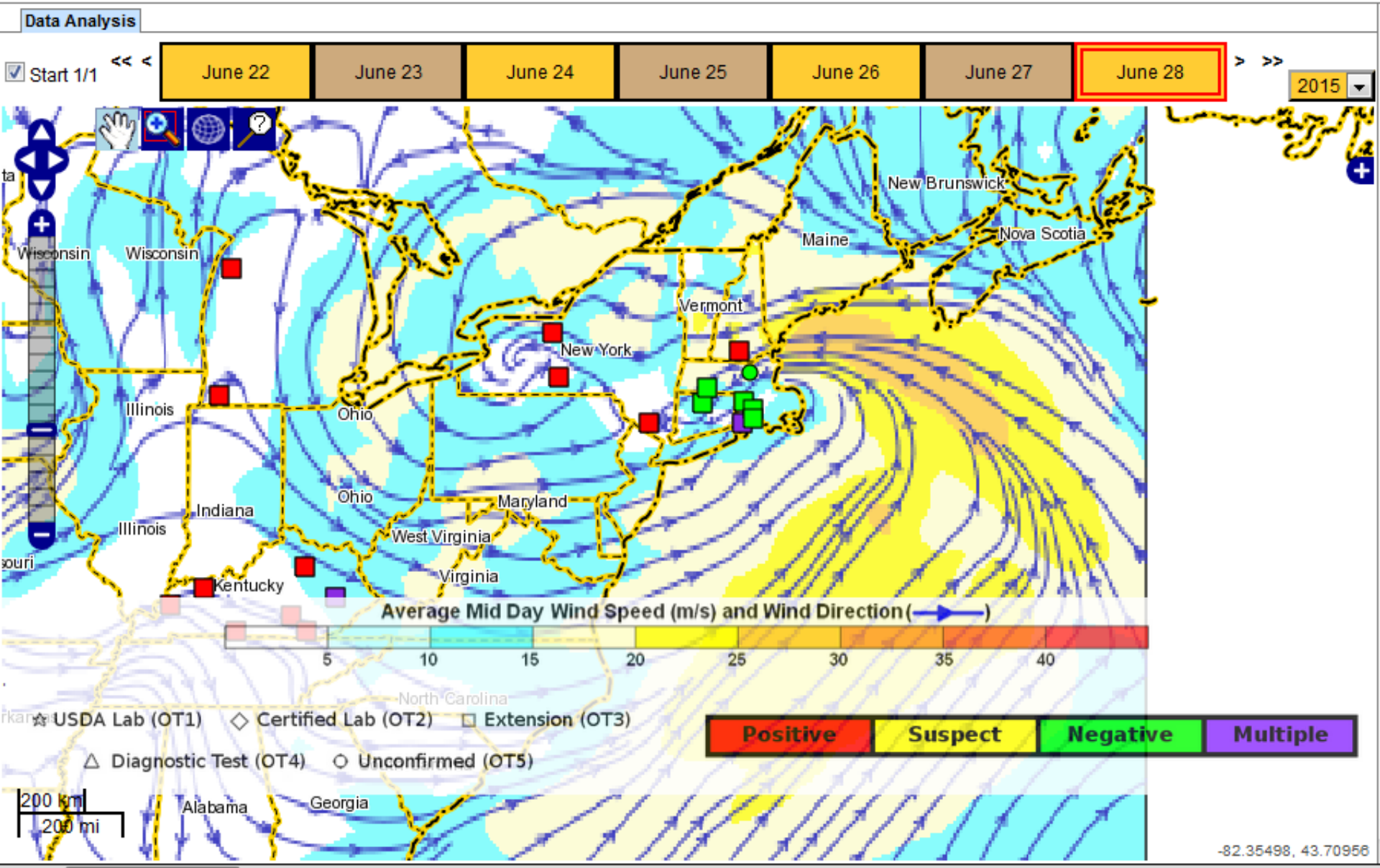
- Integrated Pest Information Platform for Extension and Education

SWD caught June 28, 2015

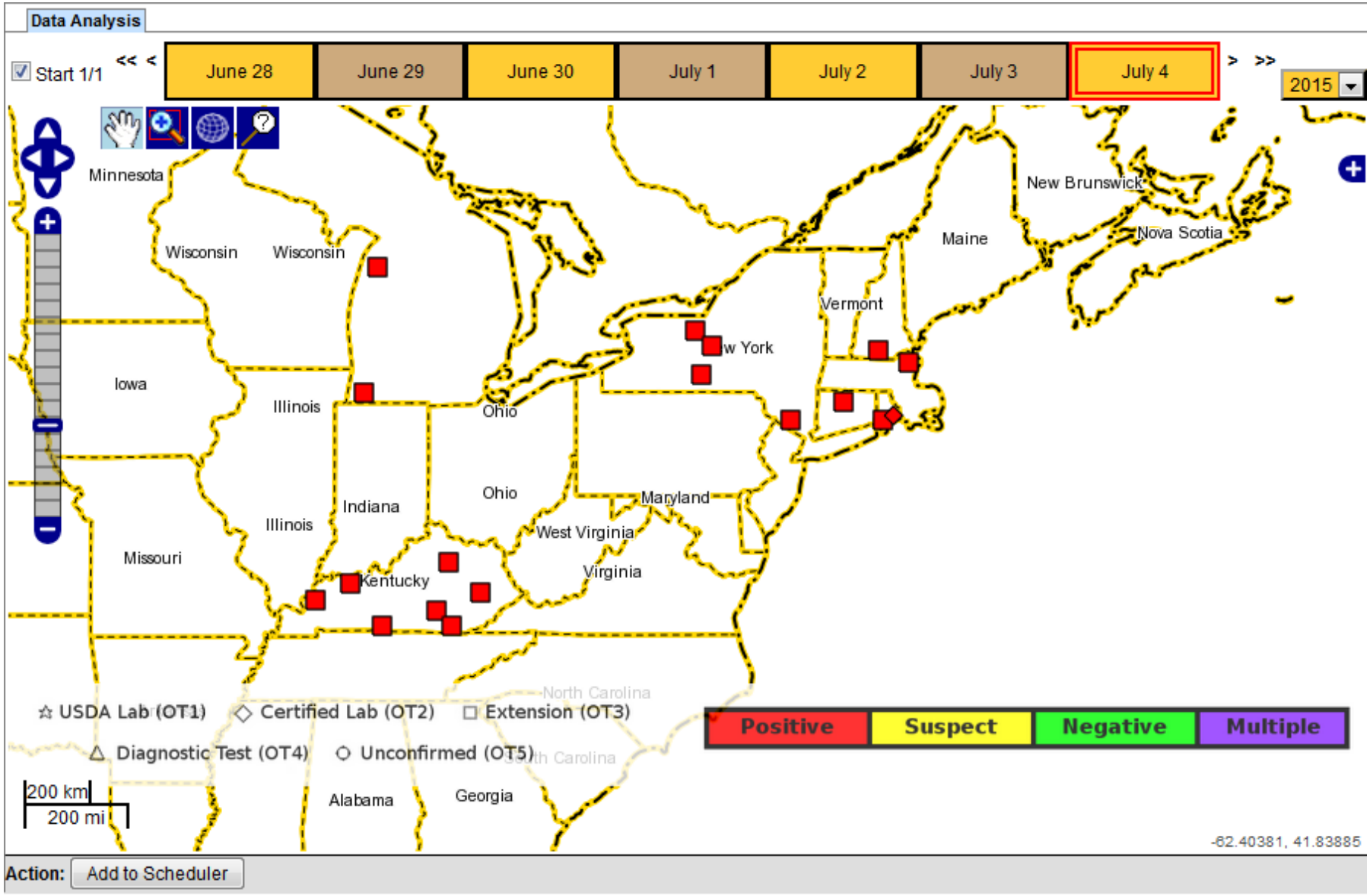



Data Analysis
Start 1/1
<< <
June 22
June 23
June 24
June 25
June 26
June 27
June 28
> >>
2015
Ontario
Maine
Vermont
New York
Massachusetts
Connecticut
Pennsylvania
Pennsylvania
Pennsylvania
New Jersey
West Virginia
Maryland
Virginia
Ohio
☆ USDA Lab (OT1)
◇ Certified Lab (OT2)
□ Extension (OT3)
△ Diagnostic Test (OT4)
○ Unconfirmed (OT5)
Positive
Suspect
Negative
Multiple
100 km
100 mi
-78.16919, 45.29998
Action:
Add to Scheduler

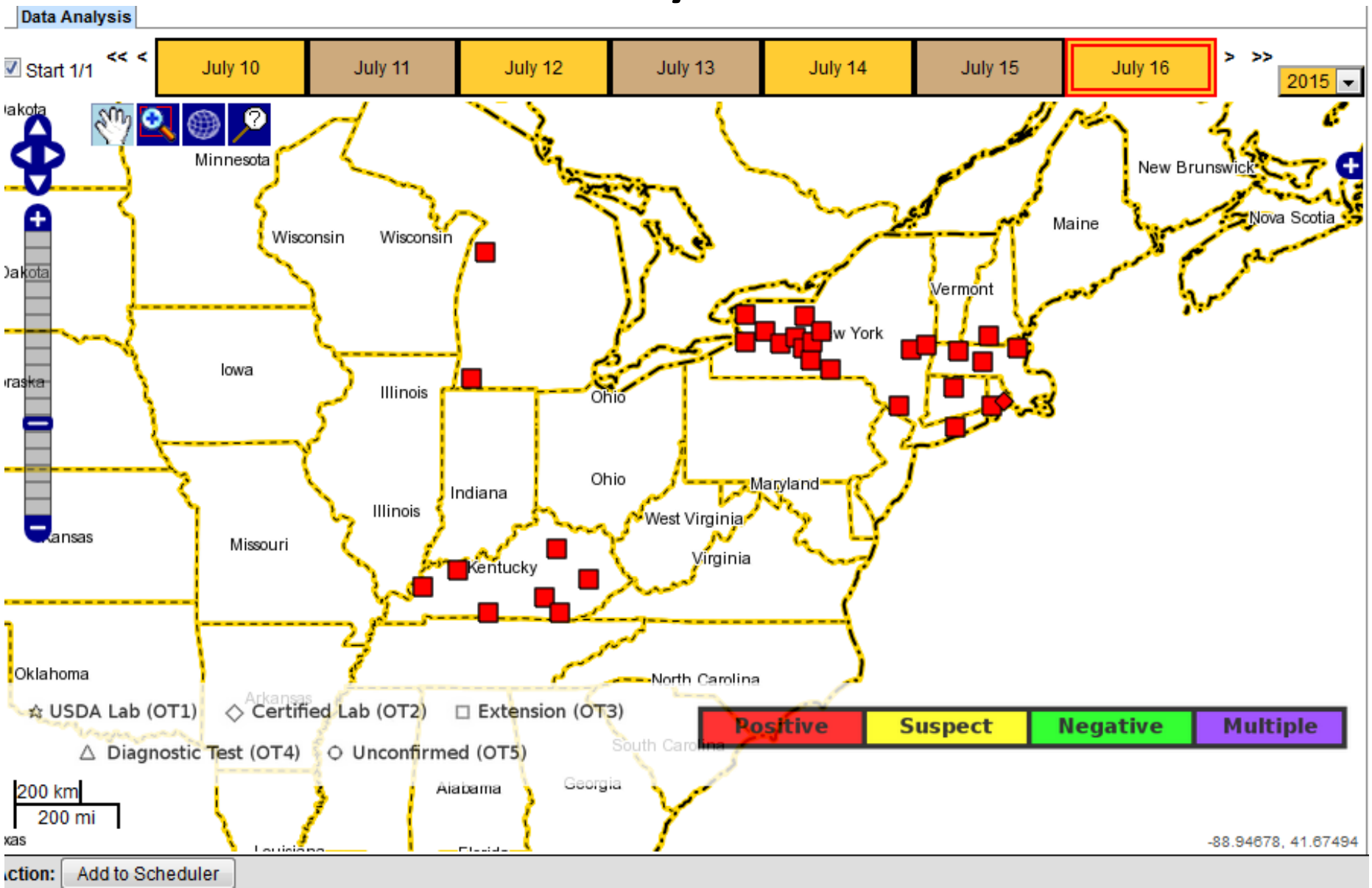
June 28 with wind direction



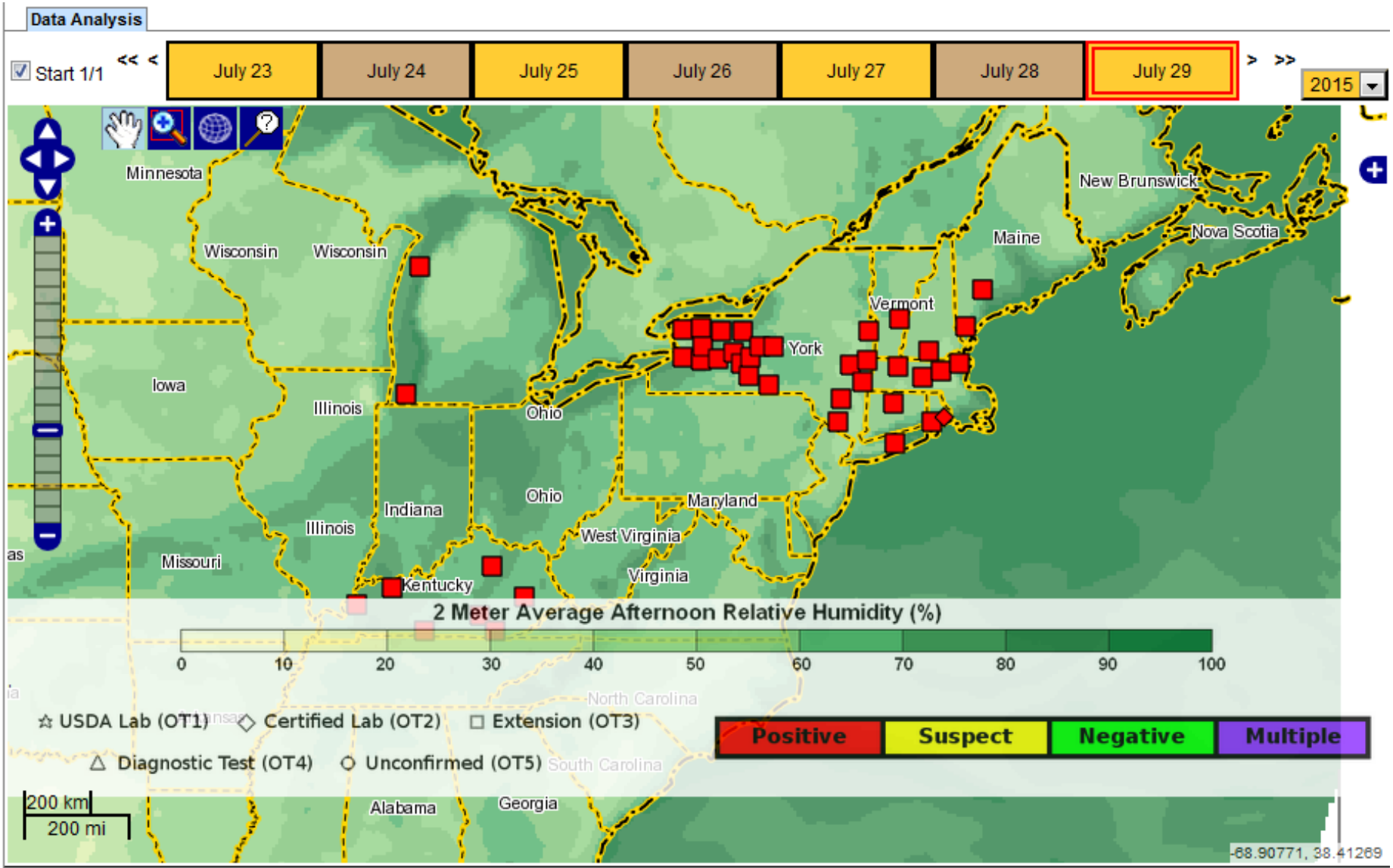
July 4th


Data Analysis
Start 1/1
<< <
June 28
June 29
June 30
July 1
July 2
July 3
July 4
> >>
2015
Minnesota
Wisconsin
Wisconsin
Iowa
Illinois
Ohio
Indiana
Ohio
Illinois
Missouri
Kentucky
West Virginia
Virginia
Maryland
w York
Vermont
Maine
New Brunswick
Nova Scotia
North Carolina
Alabama
Georgia
☆ USDA Lab (OT1)
◇ Certified Lab (OT2)
□ Extension (OT3)
△ Diagnostic Test (OT4)
○ Unconfirmed (OT5)
Positive
Suspect
Negative
Multiple
200 km
200 mi
-62.40381, 41.83885
Action:
Add to Scheduler

July 16


Data Analysis
Start 1/1
<< <
July 10
July 11
July 12
July 13
July 14
July 15
July 16
> >>
2015
Minnesota
Wisconsin
Wisconsin
Iowa
Illinois
Ohio
Indiana
Ohio
Illinois
Missouri
Kentucky
West Virginia
Virginia
Maryland
Vermont
Maine
New Brunswick
Nova Scotia
Oklahoma
Arkansas
North Carolina
South Carolina
Alabama
Georgia
USDA Lab (OT1)
Certified Lab (OT2)
Extension (OT3)
Diagnostic Test (OT4)
Unconfirmed (OT5)
Positive
Suspect
Negative
Multiple
200 km
200 mi
-88.94678, 41.67494
Add to Scheduler

July 29 with Relative Humidity



iPiPE

- Small Fruit Survey
  https://survey.ncsu.edu/IPM/NEsmallfruit/

- the pdf is here:
  https://survey.ncsu.edu/IPM/NEsmallfruit/NE%20Small%20Fruits%20Survey--FINAL.pdf