

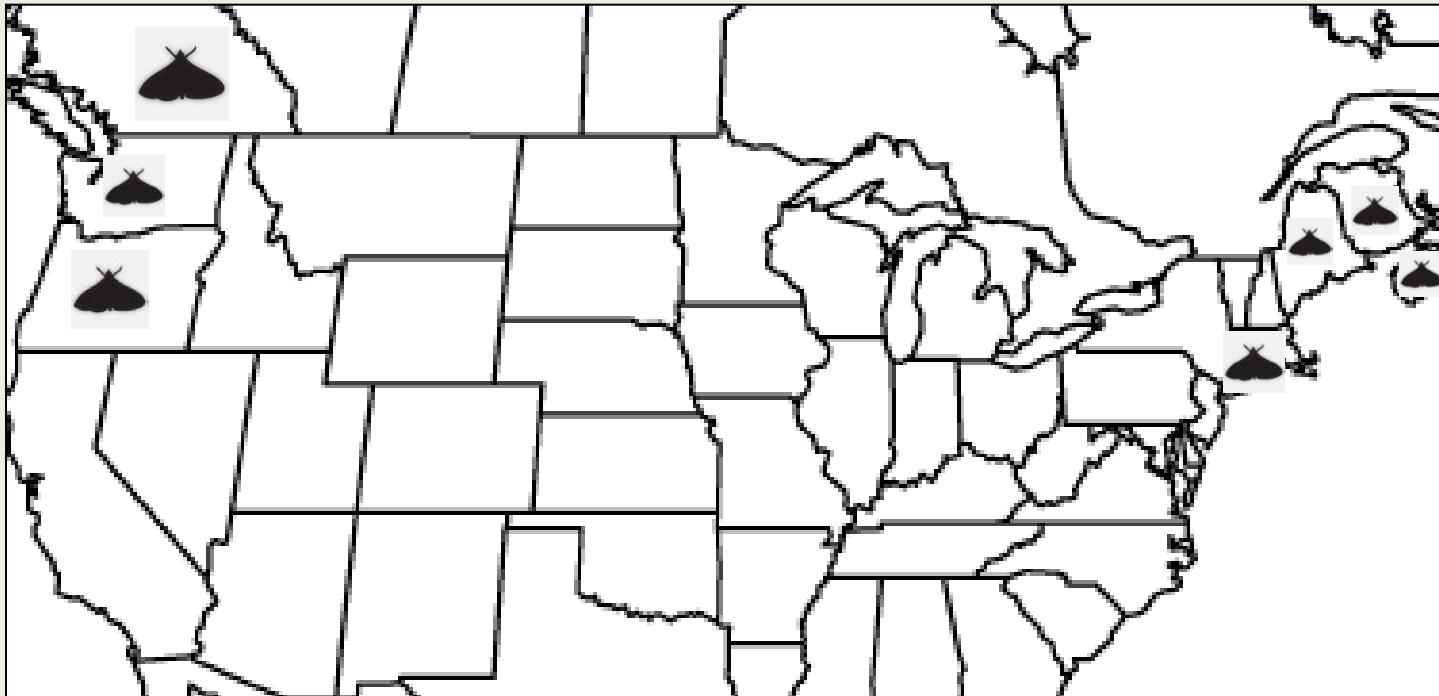


**Outbreak of winter moth  
(*Operophtera brumata*) in  
Harpswell, Maine**

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# History of Introduction

- Native to Europe
- Introduced into Nova Scotia in 1930's, spread to New Brunswick and British Columbia 1970's
- U.S. Populations in Oregon, Washington and coastal Northeast
- Massachusetts introduction, 1990's to 2000's (Elkinton *et al.* 2010)
- Overlaps with Bruce spanworm (*Operophtera bruceata*) (Eidt and Embree 1968, Gwiazdowski *et al.* 2013)







# Winter moth in Maine

- Adults first seen in Harpswell, ME in 2011
- First defoliation reported in May 2012, Harpswell and Vinalhaven
- Larvae defoliated 400 acres in Harpswell in 2012
- Additional populations found along the coast: Kittery to Rockland plus reports in MDI
- Local interest and involvement
- Reports from this past fall: locals said it was “like driving through a snowstorm”





## Field Sites



www.google.com/map

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Two sites along Harpswell Neck Road (rt. 123)



# Life History



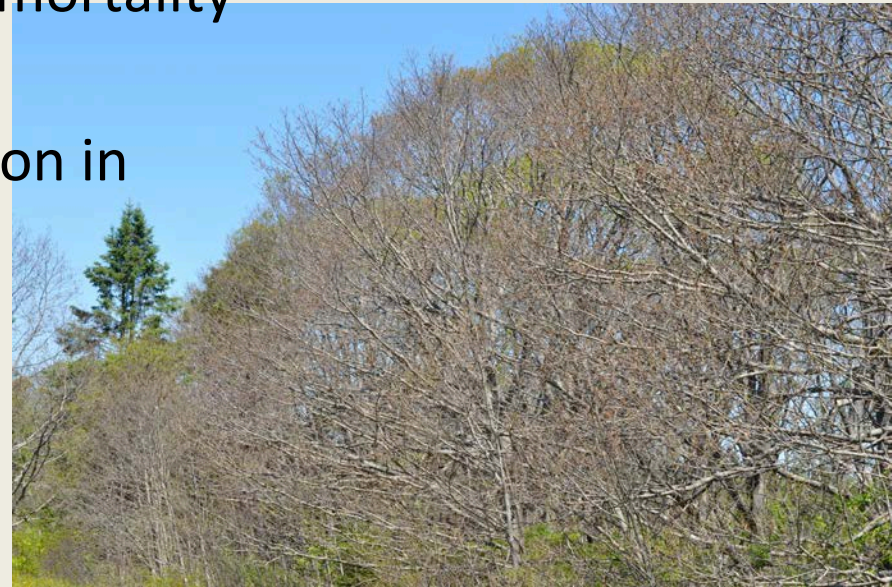
Eggs

- Adults emerge in winter (Nov-Jan)
  - Males fly, mate with flightless females
  - Females lay eggs on bark of host tree
- Larvae emerge in late spring
  - Synchronized with leaf bud burst
  - Enter leaf and flower buds
  - Disperse by ballooning
- Pupate in the ground throughout summer



# Host Plant Damage

- Generalist herbivores, very wide range of hosts
  - Includes: oak, birch, maple, ash, apple, highbush blueberry
  - Evergreen hosts include heather, sitka spruce, cranberry
- Severe defoliation—leads to plant mortality after several years
- Forest pest: complete oak defoliation in Harpswell in 2013



# Damage to Blueberries



- Agricultural pest in apple, highbush blueberry (Canada), cranberry (Massachusetts), European blueberry
- Outbreaks in heather—can persist in open fields (Kearslake 1997)
- In B.C. winter moth feed during peak highbush bloom
- Decrease in fruit production/profit (Holliday 1977)
- Observed feeding on lowbush blueberry in field and lab







# Natural Causes of Mortality

- Bio-control: Tachinid parasitoid
- Winter mortality in native range (Varley and Gradwell 1968)
- Pupal predators
- Disruption in synchrony
- Pathogens and parasites





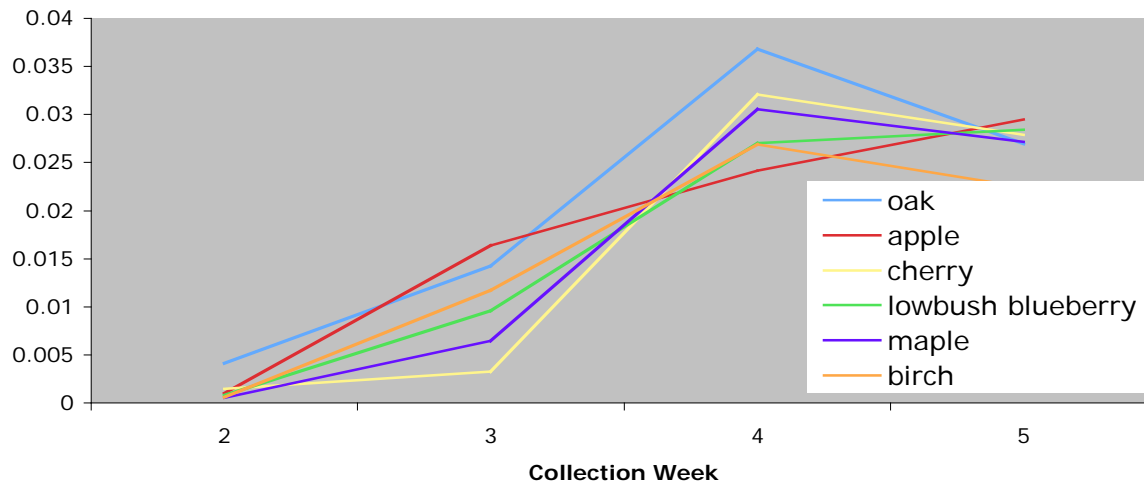
# Development and Survival on Different Host Plants

- Collected caterpillars from 6 different host plants each week from May 7 2013-June 6 2012
- 50 caterpillars/plant/week set up in rearing cups with host plant
- Survival: examined survival over time, number pupated, pupal weight
- Development: remaining caterpillars weighed and measured



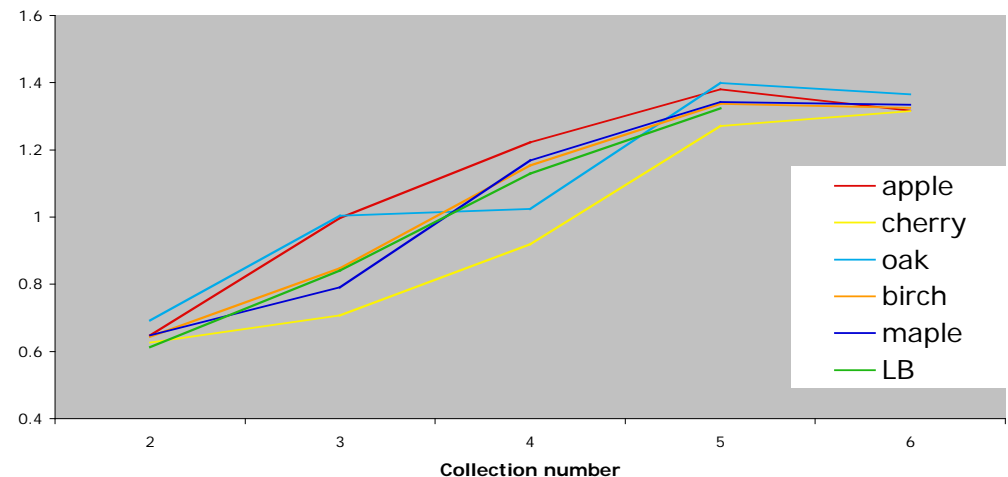
# Field Collected Larval Development

Winter moth larval weights over four weeks of development



Development on lowbush blueberry comparable to other host plants

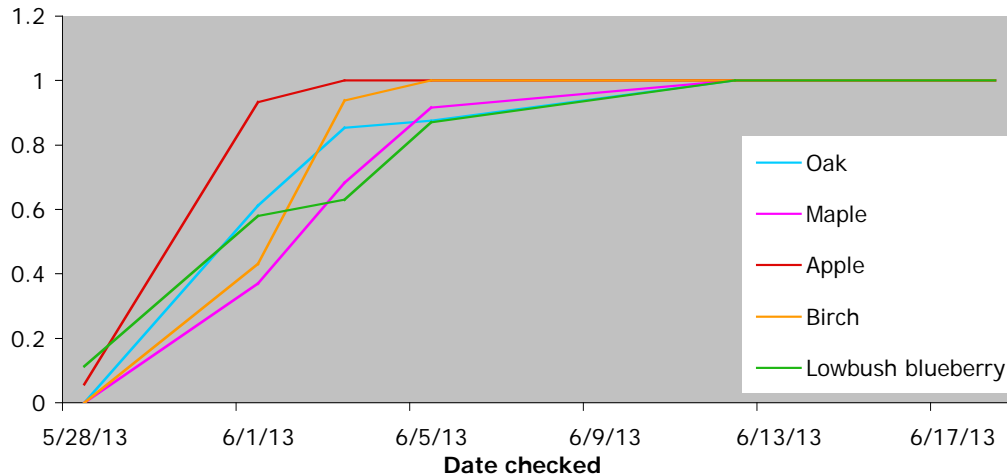
Head capsule size on different host plants over five weeks of development





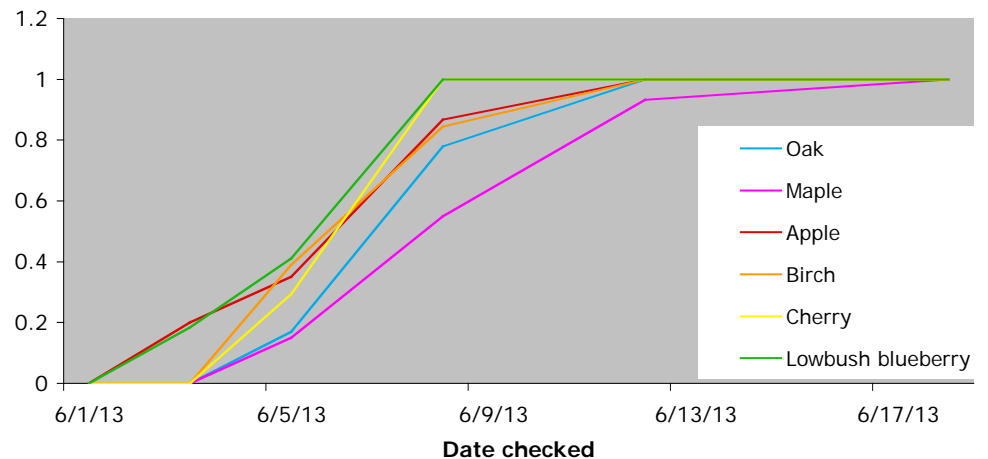
# Lab Pupation Over Time

Collection 3: Proportion of pupated individuals from each host plant



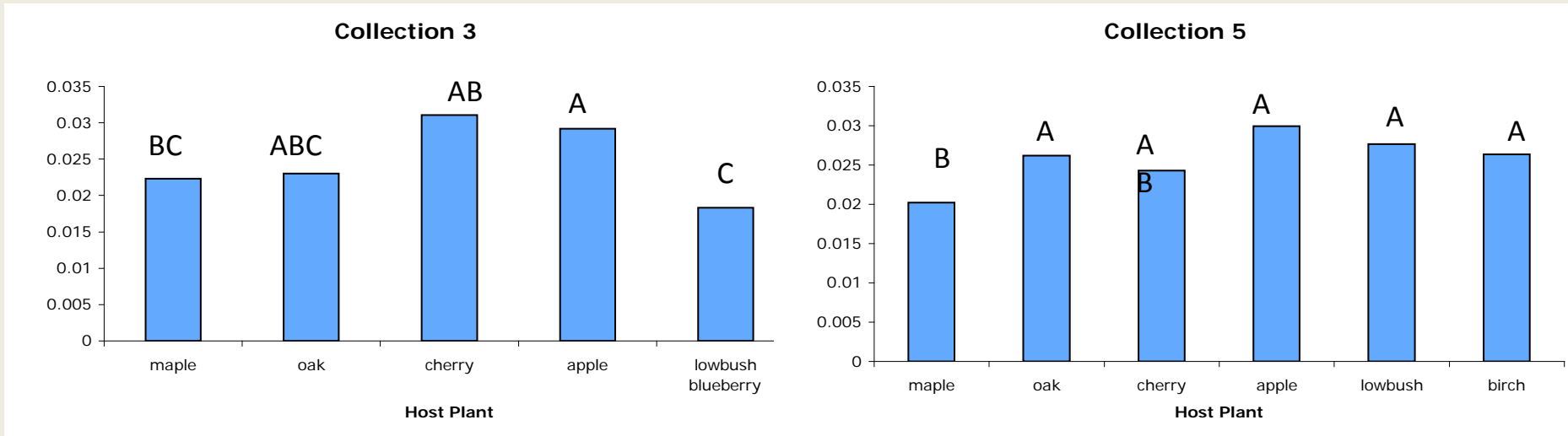
Collection # 3: caterpillars fed on lowbush blueberry took longer to pupate

Collection 4: Proportion of total individuals pupating per host plant



Collection # 4: caterpillars fed on lowbush blueberry reached pupation faster than on other host plants

# Weights of surviving pupae after lab rearing experiment



Letters indicate significance

Host plant effect significant ( $p < 0.0001$ )

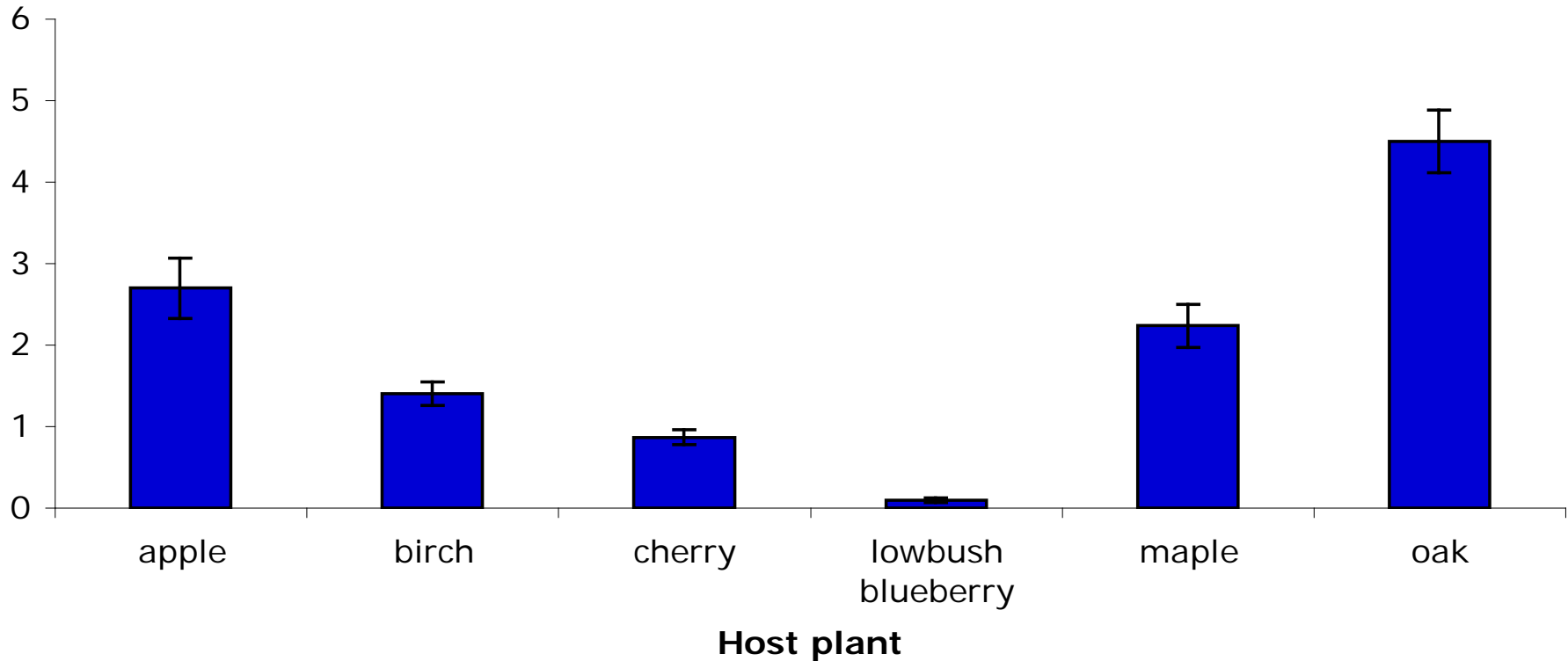


# Population Density

- Counted winter moths per 10 cm of stem on 6 different host plants
  - Oak, apple, maple, cherry, birch, lowbush blueberry



## Number of winter moth caterpillars per bud on six different host plants



Lowbush blueberry—high bud count, although caterpillars/bud is low, caterpillars still attack plants in a natural setting



# Watch for Winter Moth

- Attack lowbush blueberry—especially flower buds
  - Anecdotal reports of lower apple and lowbush blueberry yield in Harpswell, ME
- Possible field border pest—persist in oaks along field edges
- Movement into fields via ballooning problematic
  - Heather in Scottish Moorlands
- Traditional blueberry management practices may help protect fields—more research needed
- Be on the lookout—report sightings, online survey through Maine Forest Service webpage

# Questions?

