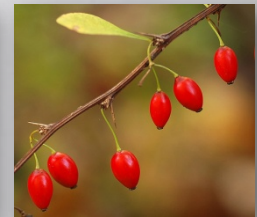
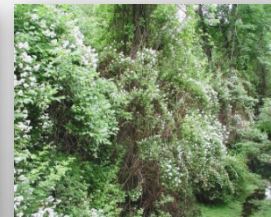




MAINE'S MOST UNWANTED



What are invasive species?

- Are not naturally found in the area
- Cause harm to:
 - environment
 - economy
 - human health
- Any benefits are outweighed by harm



Japanese Barberry, CTAES

Most non-native (alien) species are not invasive

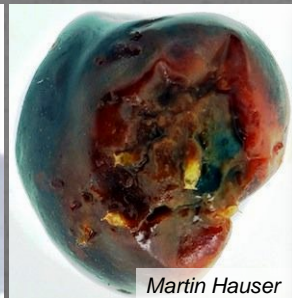
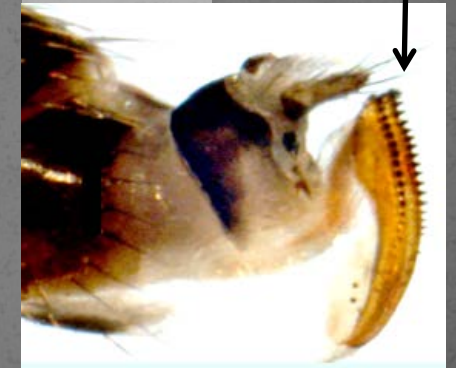
Spotted Wing Drosophila (SWD)

Drosophila suzukii

Vinegar Fly

Attacks ripening fruit

- Prefers soft-skinned fruit
 - blueberry, blackberry, cherry, grape, peach, plum, raspberry, strawberry...
- Will attack harder fruits if skin is broken
 - apple, pear, tomato, kiwi...



SWD Life Cycle



Adults overwinter – wooded field edge

Adults
20-30+
days

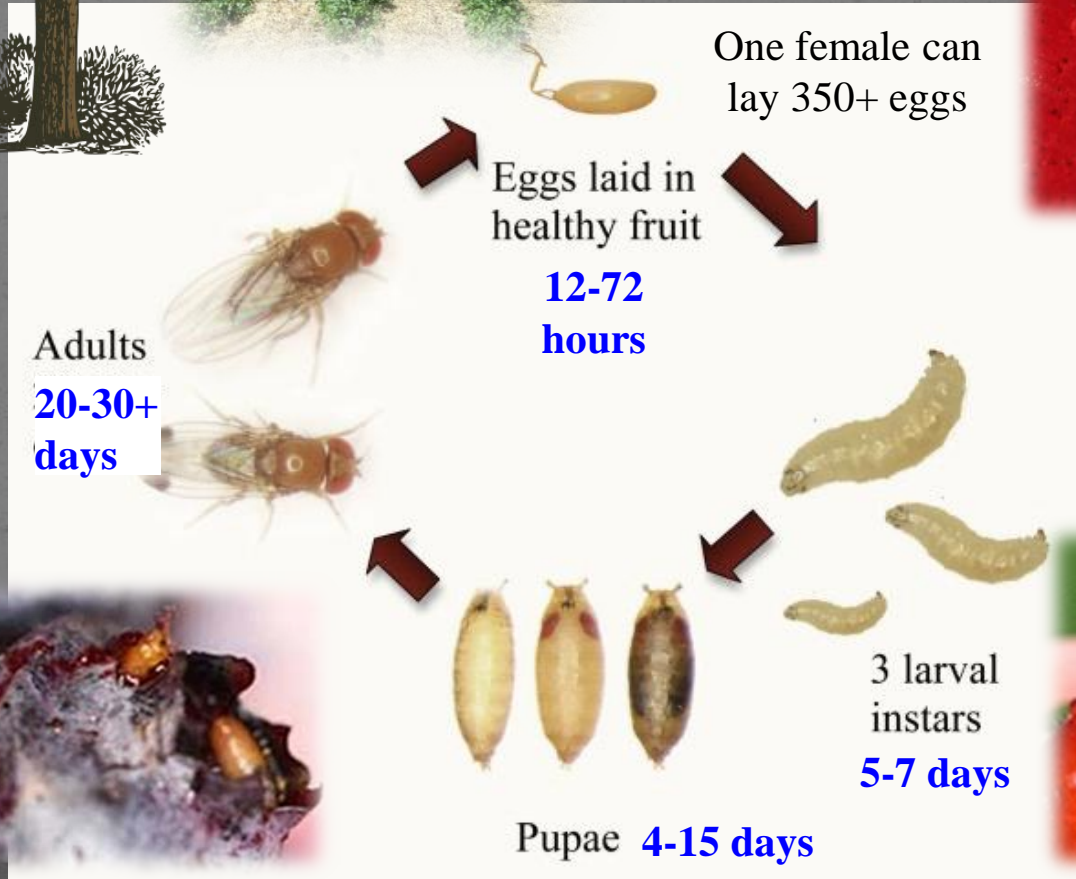
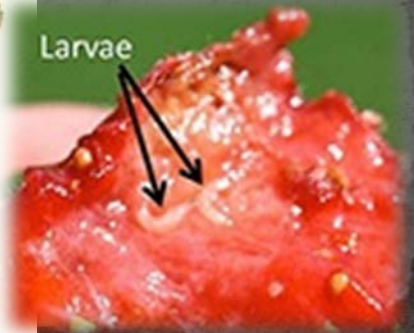
One female can lay 350+ eggs

Eggs laid in healthy fruit

12-72
hours

3 larval instars
5-7 days

Pupae 4-15 days



Spotted Wing Drosophila 2013

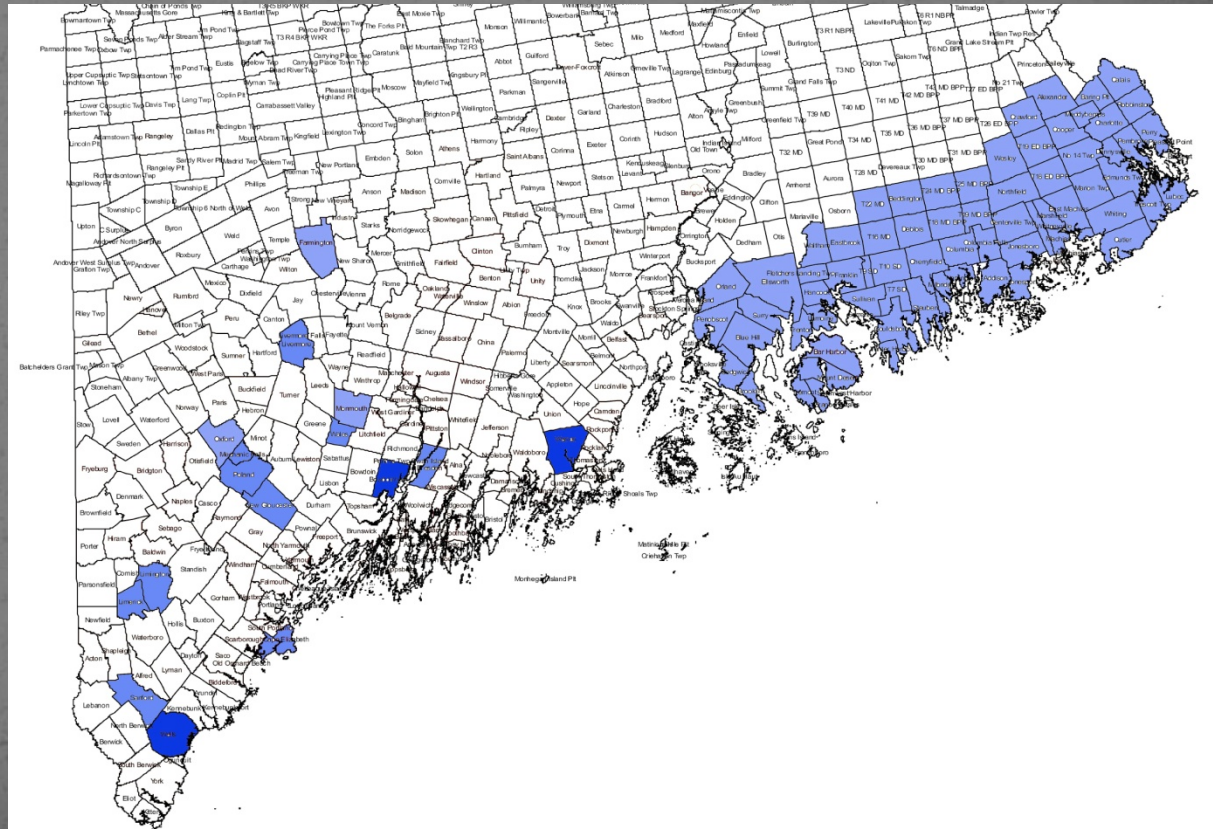
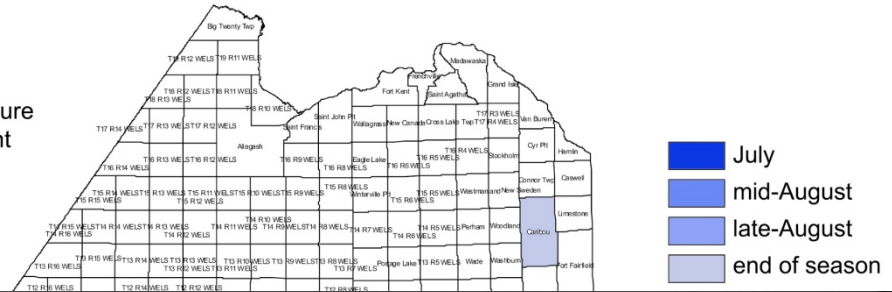
Maine, 2011

- Fall raspberries

2013

- Trapped berry fields - southern, central, coastal Maine
- First SWD, July 19 (Warren)
- Catch counts fairly low until September
- Highest numbers in southern and coastal sites
- SWD caught until late November
- Caribou – 3 SWD caught

February 2014
Maine Department of Agriculture
Division of Animal and Plant
Health
(data from UMCE)



Six Rules for Managing Spotted Wing Drosophila:

- Monitor for the flies with traps, and for the larvae in fruit.
- Spray regularly and often once flies have been found in the field (1-2/week).
- Harvest fruit regularly and often; do not leave any ripe/rotten fruit in the field.
- Sort fruit at harvest; do not leave any soft fruit in the container to be sold.
- Chill all fruit immediately after harvest to 38°F (or as close as you can) for at least 12 hours to slow development of any eggs or larvae.
- Prune the planting to open up the canopy and create dry, light conditions.



University of Maine Cooperative Extension

<http://umaine.edu/highmoor/news-events/>

Brown Marmorated Stink Bug (BMSB)

Halyomorpha halys



Photos: Rutgers
Cooperative Extension
njaes.rutgers.edu



Eggs laid on
undersides of
leaves

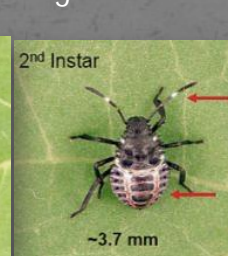
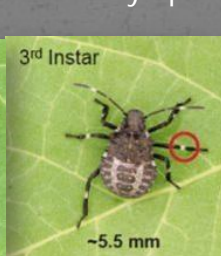


5 nymphal stages



D. Shetlar, OSU

A “true bug” –
piercing/sucking
mouthparts



- 1 generation/year in northeast
- adults overwinter (in buildings) and live 6-8 months

What does it do?

- Attacks a wide variety of fruits, vegetables, ornamentals and legumes
 - over 100 host plants documented
 - stone fruits, apples, tomatoes, peppers, corn, soybeans, roses, crabapple...
 - adults and nymphs – pierce the fruit; suck out nutrients



Stephen Ausmus



Chris Bergh, Virginia Tech



UMD Extension UMD Extension

- BMSB is a home invader
 - overwinters in buildings/homes
 - emits stinky odor



2011.09.25



Steve Ruark, The New York Times

Recognizing BMSB



Mike Quinn, TexasEnto.net

Melinda Fawver

Brown stink bug
(*Euschistus servus*)

Bark stink bug (*Brochymena*
quadripustulata)

Brown marmorated stink bug
(*Halyomorpha halys*)

BMSB has:

- black and white pattern around abdomen
- white bands on dark antennae
- smooth pronotum

What Can You Do

Learn about BMSB

www.stopbmsb.org

Report suspicious sightings

BMSB is a home invader pest first

Stop BMSB
Biology, ecology, and management of brown marmorated stink bug in specialty crops

Search

ABOUT US
Project, people, research...

STINK BUG BASICS
Origins, life stages, photos...

WHERE IS BMSB?
Maps, crops, sightings...

MANAGEMENT
Monitor, deter, manage...

MORE RESOURCES
News and videos...

Overview

The brown marmorated stink bug, *Halyomorpha halys* (Stål), is a voracious eater that damages fruit, vegetable, and ornamental crops in North America. With funding from USDA's Specialty Crop Research Initiative, our team of more than 50 researchers is uncovering the pest's secrets to find management solutions for growers, seeking strategies that will protect our food, our environment, and our farms.

Updates

Tracking the Brown Marmorated Stink Bug This new video series shows growers and others how to identify BMSB, why this pest is important in agriculture, and what's at stake if we don't stop it.

Scientists publish on stink bug's favorite plants, damage Researchers unveil a list of 170 plants that the brown marmorated stink bug attacks, and web videos show how to monitor for infestations.

Taking on the Menacing Stink Bug The Brown Marmorated Stink Bug has been causing trouble for homeowners and farmers from New Hampshire to California for three years. NPR's Alan Yu reports there may be a solution. Source: *Hear & Now*, December 25, 2013

From 'Death Jars' to Wasps: A quest to stamp out the stink bug From coast to coast, the invasive insect is costing U.S. farmers millions in crop damage, and it has become a smelly nuisance for homeowners. Source: *NPR*, December 17, 2013

Wanted Dead or Alive (No, Just Dead) Observing stink bug predators in the garden could lead to better biological control of BMSB. Source: *The New York Times*, November 27, 2013

Spread of Asian stink bug threatens U.S. crops The invasive stink bug continues to spread across the United States, alarming both farmers and scientists. Source: *Voice of America News*, November 13, 2013.

Pest Alert: Brown Marmorated Stink Bug Pest alert on brown marmorated stink bug, HTML. Source: *UC Davis*.

Chinche Apestosa Marron Marmorea Español: Chincheapestosa marrón marmórea, HTML. Source: *UC Davis*.

Funding

USDA United States Department of Agriculture National Institute of Food and Agriculture
Specialty Crop Research Initiative

Collaborators

OSU Oregon State University
RUTGERS UNIVERSITY
PENNSTATE UNIVERSITY
VirginiaTech
UNIVERSITY OF MARYLAND
WASHINGTON STATE UNIVERSITY
Northwestern IPM Center
Cornell University
NC STATE UNIVERSITY

Hemlock Woolly Adelgid (HWA)

Adelges tsugae

- Host = hemlocks
(different adelgids on other conifers)
- Causes decline/mortality of hemlocks
- Attached to twig at base of needle
- Key to detection: white waxy masses attached to twigs

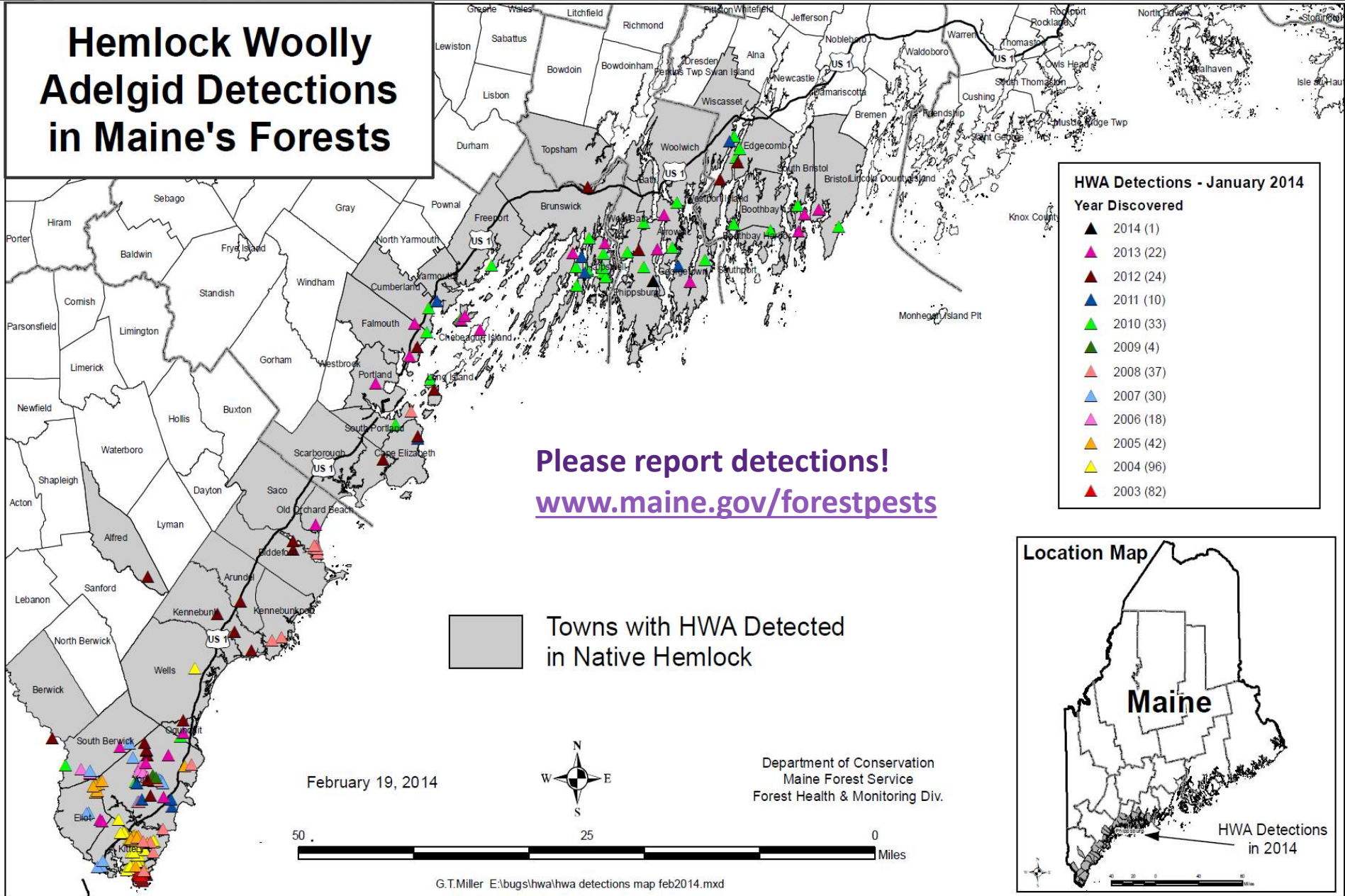
Wool most visible December through June



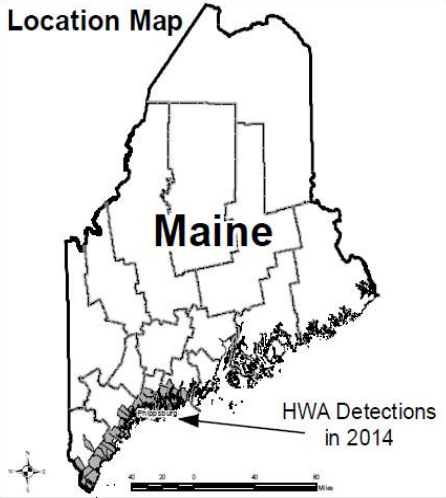
Can be hard to see from July through October
– crawlers are invisible



Hemlock Woolly Adelgid Detections in Maine's Forests



Please report detections!
www.maine.gov/forestpests





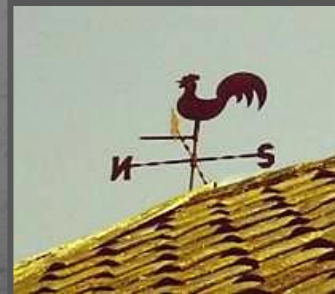
How do WE move them?

- Year Round - live plants
- March-July (crawlers/eggs)
 - Severed hemlock
 - Clothing, Machinery, etc.



What about natural spread?

- March-July (crawlers/eggs)
 - Wind and weather
 - Animals



HWA Management

Physical/Cultural :

- Prune at-risk material/infested material (August-Mar)
- Isolate from yard care / other delivery / maintenance (consider mulch)
- Replacement

Biocontrol: Forest



Chemical:

- Oil/Soap -- foliar
- Neonicotinoid systemic –soil / basal bark / trunk
- Combination



Regulatory: Quarantine (rooted plants, top material)

Winter Moth(WM)

Operophtera brumata



Waltham Services

Adults: Nov - Jan



Tom Murray, BugGuide.net

Eggs: Dec - Apr



Gyorgy Csoka,
Hungary Forest
Research Institute,
Bugwood.org



Cape Cod Times/Steve Heaslip

Larvae: Apr - Jun



Maine Forest Service

Pupae: Jun - Nov



Hannes Lemme, Bugwood.org

What does WM do?

Larvae feed in early spring

- On newly forming buds
- Then free-feed on expanded foliage
- Causes "swiss cheese" effect

Defoliate hardwood trees and shrubs

- 89,000 acres in 2011 (MA)
- Extensive oak mortality
- Problems seen in highbush blueberries, cranberries, apple orchards...

Favored hosts:

- oak
- apple
- maple
- birch
- basswood
- blueberry
- cherry



Risk of Spread

WM is in the soil from June - November!

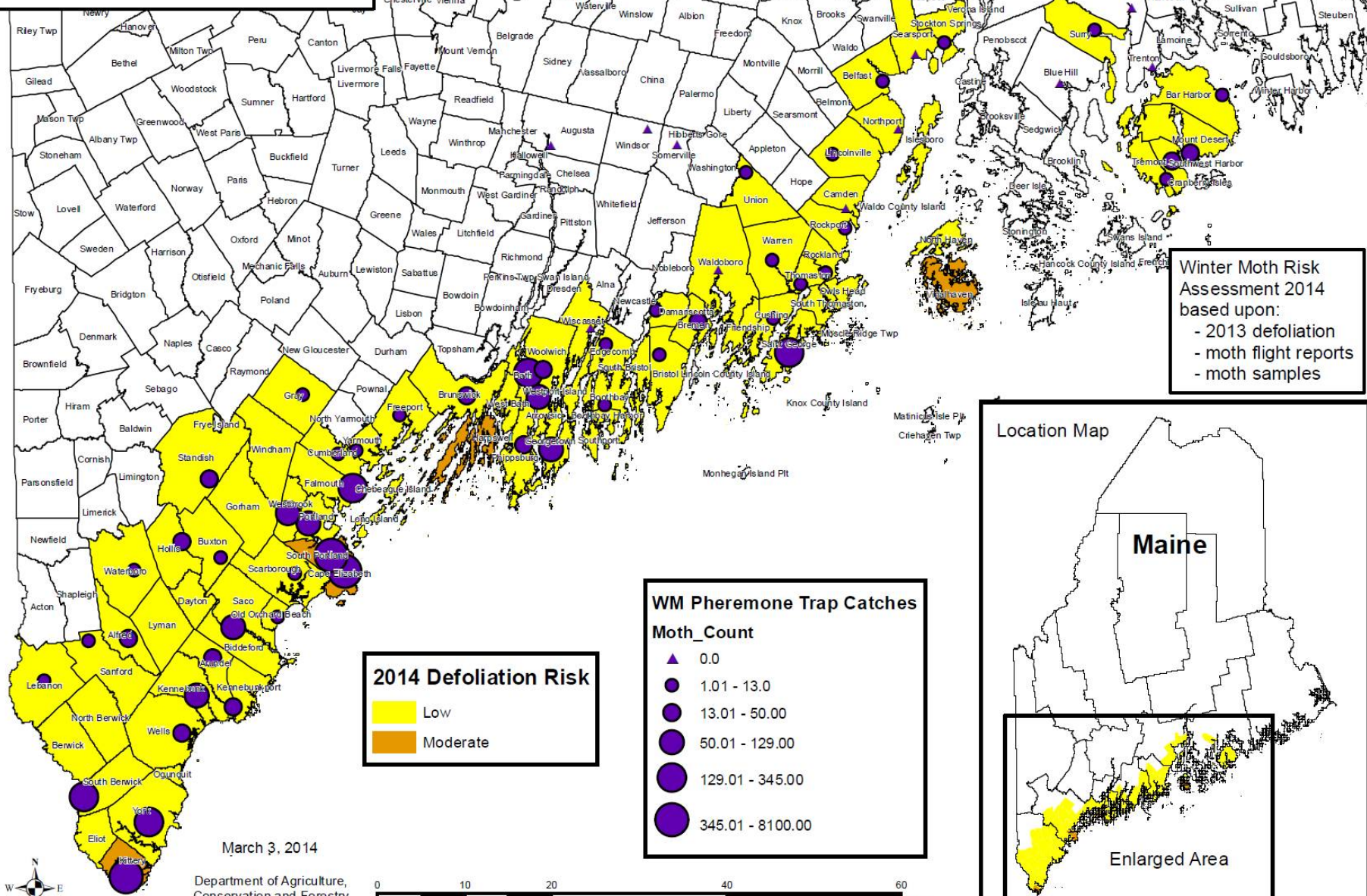
- Coccoons look like dirt

WM is on host plants from November - June

Host plants and soil from infested areas are potential carriers



Winter Moth (*Operophtera brumata*) Defoliation Risk 2014



Winter Moth Risk Assessment 2014 based upon:
 - 2013 defoliation
 - moth flight reports
 - moth samples

2014 Defoliation Risk
 Low
 Moderate

WM Pheremone Trap Catches
Moth_Count
 ▲ 0.0
 ● 1.01 - 13.0
 ● 13.01 - 50.00
 ● 50.01 - 129.00
 ● 129.01 - 345.00
 ● 345.01 - 8100.00

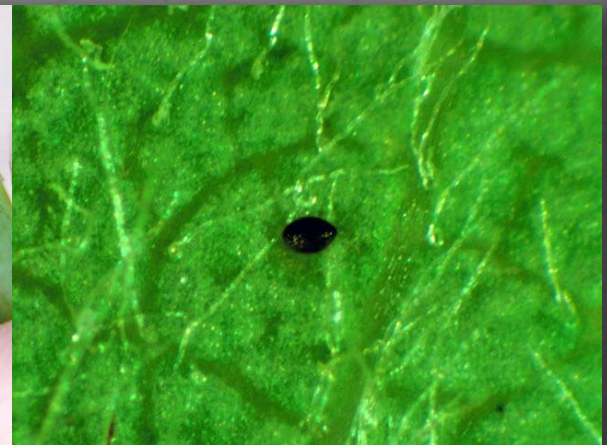
March 3, 2014

Department of Agriculture,
 Conservation and Forestry
 Maine Forest Service
 Forest Health & Monitoring



WM Management Options

- Monitor
 - Adults - November to January – tree banding or pheromone traps
 - Larvae – April - visual
- Dormant oil sprays – overwintering eggs
- *Bacillus thuringiensis* kurstaki
 - Works best on young larvae, but not effective if larvae are feeding inside buds
- Other sprays – spinosad, tebufenozide, insecticidal soap, carbaryl, malathion, pyrethroids
- Biological control
 - Parasitic fly – *Cyzenis albicans*
 - Successful control in Nova Scotia
 - Also in British Columbia and now in Massachusetts

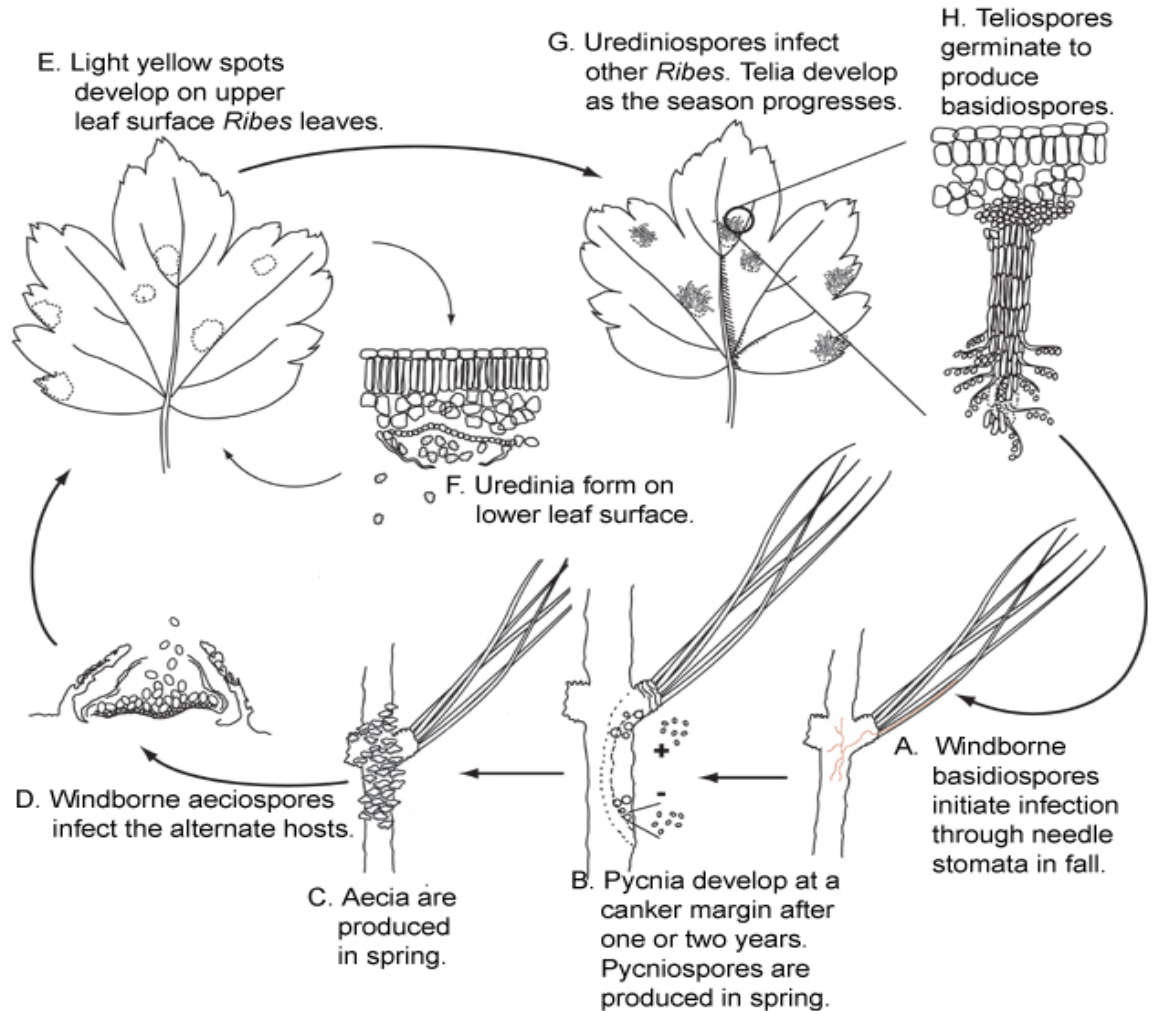


Eggs are laid on surface of host leaves

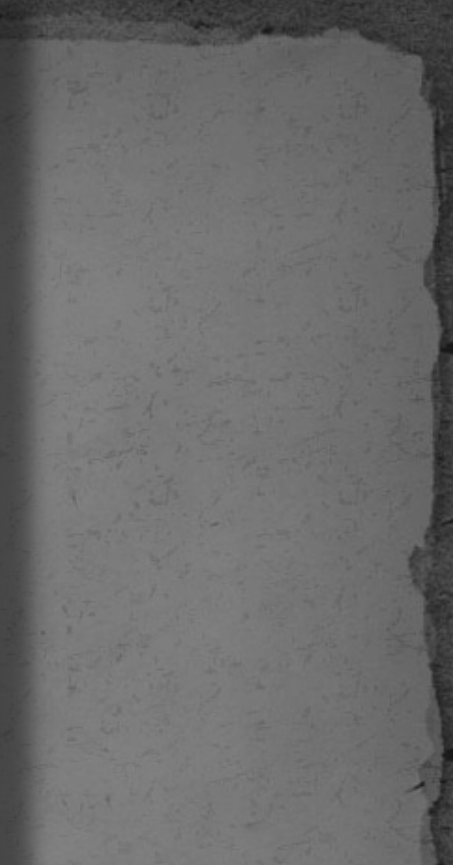
White Pine Blister Rust (WPBR)

Cronartium ribicola

Disease of 5-needle pine and *Ribes* spp.



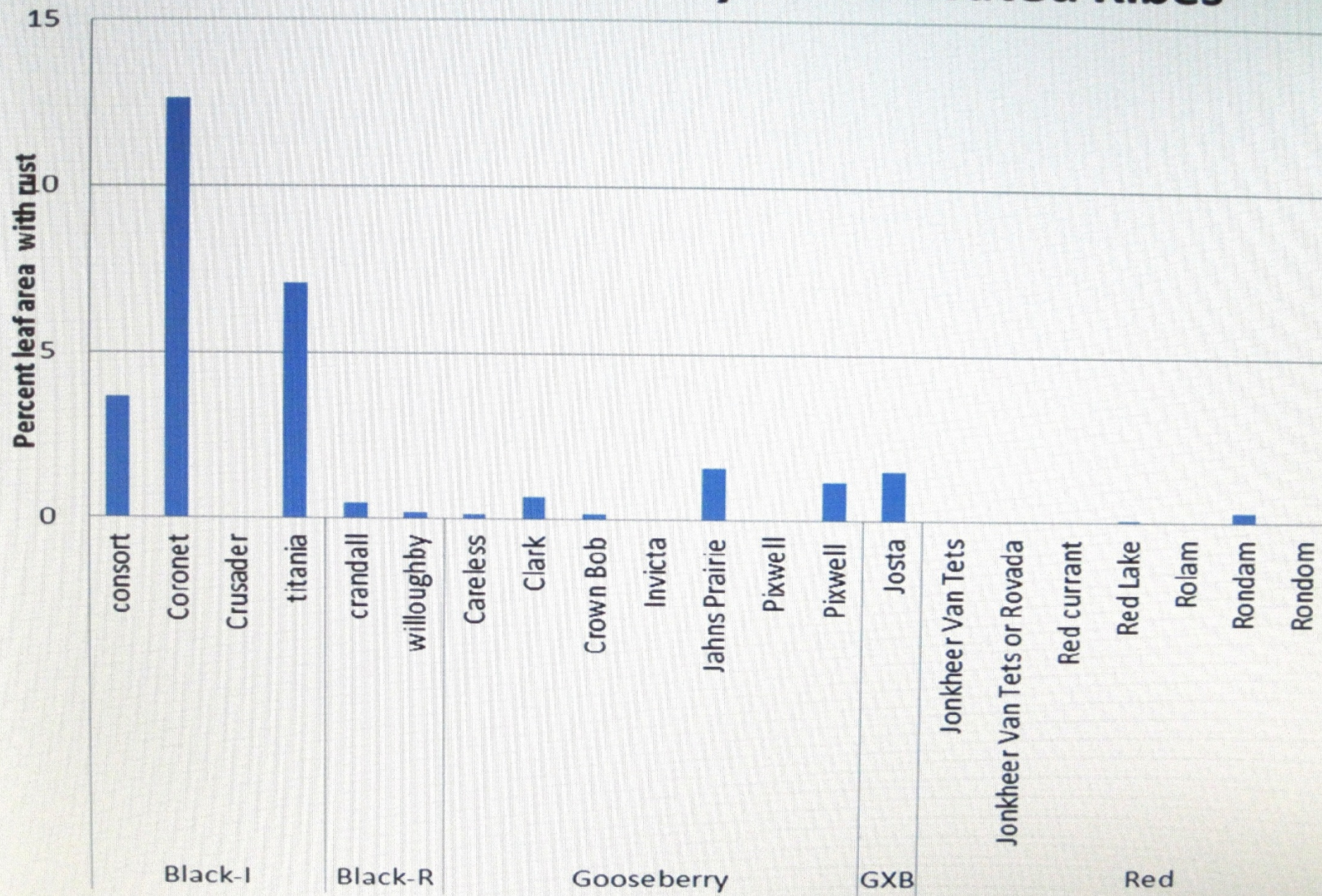
White Pine Blister Rust Disease Cycle (Drawing by Vickie Brewster).



On Ribes: Severity Ratings (%):
1, 5, 12
25, 50, 75



WPBR severity on cultivated Ribes



Quarantine Currants and Gooseberries

- Planting of plants in genus *Ribes* (currants and gooseberries) prohibited on town-by-town basis
- The planting or possession of European black currant, *Ribes nigrum* or its varieties anywhere within the boundaries of the State of Maine is prohibited.

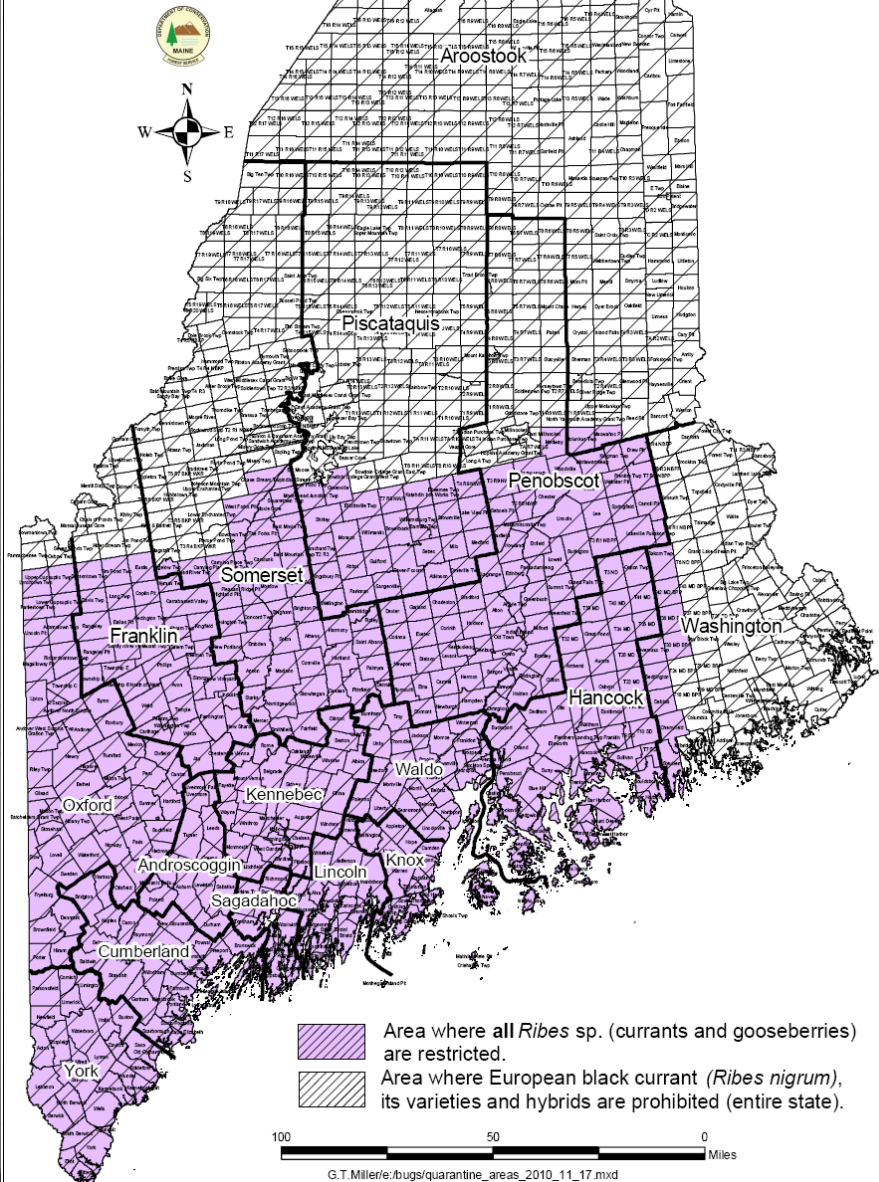
http://www.maine.gov/dacf/mfs/forest_health/diseases/white_pine_blister_rust_rule.htm

White Pine Blister Rust

Quarantine Area

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Div.

March 1, 2010



Impatiens Downy Mildew (IDM)

Plasmopara obduscens

- Caused by fungus *Plasmopara obduscens*
 - not the same pathogen that causes downy mildew on other crops
- Only infects *Impatiens walleriana* & *Impatiens balsamina*
 - May also infect jewelweeds
- Spread by:
 - Infected plant material
 - Spores that blow long distances in the wind or that splash from plant to plant
 - Produces resting spores that may overwinter in the soil



IDM Symptoms



Yellowing, downward
curling foliage



White fluffy growth on
underside of leaf



Defoliation

IDM Recent History

- Grower response to threat
 - Most grew fewer impatiens,
 - Customer education
- Most common replacements
 - New Guinea impatiens, begonia, torenia, coleus
- Reports of IDM in Maine 2013
 - 4 in August & September (Bath, Bangor, Portland, Orono)
 - No symptoms observed at greenhouses
- Why fewer reports of IDM?
 - Fewer impatiens grown
 - More preventative measures
 - Possibly unfavorable weather conditions



The graphic features three photographs: a garden bed with affected plants, a healthy pink-flowered impatiens plant, and a close-up of a leaf with white fuzzy growth. The text is organized into sections: 'Get the Facts', 'THREAT', 'HOSTS', 'SYMPTOMS', 'TREATMENT', and 'Impatiens Downy Mildew in the Home Garden'. It provides detailed information on the pathogen *Plasmopara obducens*, its effects on various impatiens varieties, and prevention and treatment strategies for home gardeners.

Impatiens Downy Mildew

Get the Facts

THREAT

- Downy mildews caused by the pathogen *Plasmopara obducens*

HOSTS

- Infects only garden Impatiens. New Guinea Impatiens and other plants are not affected.

SYMPTOMS

- Yellowing of foliage and white fuzzy coating on undersurface of leaves. Eventual plant collapse.

TREATMENT

- Infected plants will not recover. Remove plants with symptoms, including roots. Do not compost. Bag and discard in the trash. Re-plant with plants other than Impatiens, such as begonia, coleus or New Guinea Impatiens.

Impatiens Downy Mildew in the Home Garden

Impatiens downy mildew has emerged as a serious new threat to Impatiens plants. The disease, caused by the pathogen *Plasmopara obducens* affects all varieties of Impatiens. New Guinea Impatiens and other plants are not affected. Symptoms to look for include yellowing of the upper leaf surface and downward curling foliage. Upon closer examination the under surface of the leaf is covered in a white fuzzy growth. As the disease progresses the leaves and flowers drop, leaving bare stems behind. Plants in the garden can become infected by spores in water splashed from nearby infected plants, spores that are blown by the wind long distances or by spores that overwintered in the garden soil. Cool humid conditions will encourage disease development. Avoid planting Impatiens in environments where leaves stay wet for long periods of time such as in dense shade, or crowded plantings with poor air circulation. Avoid overhead irrigation and water plants early in the day when foliage has plenty of time to dry before nighttime. Plants that are infected with Impatiens downy mildew will not recover. Immediately remove infected plants including the roots, bag and discard. Do not compost plants with Impatiens downy mildew. Do not replant Impatiens on sites where infected plants have been observed in the past. Substitutes for Impatiens include begonias, coleus and New Guinea Impatiens.

Maine Department of Agriculture, Conservation and Forestry
215 State House Station
Augusta, ME 04333

TEL: (207) 287-3851
WWW.MAINE.GOV/AGRICULTURE/INDUSTRIALCULTURE

IDM Future

- Impatiens downy mildew is still here
- Continue to use caution when deciding what to grow for impatiens next season
- If you do grow impatiens continue to:
 - use preventative measures,
 - scout your crop,
 - take action if symptoms are observed



Invasive Plants

- ~ 2,100 plant species recorded from Maine
- ~ 1/3 of those are not native
- A small fraction of those are considered invasive
- These have the potential to cause great harm to our landscape



- Increase the costs of agriculture
- Affect forest regeneration
- Threaten our recreational experiences
- Decrease property values
- Outcompetes native species
- Change animal habitat by eliminating native foods, altering cover, and destroying nesting opportunities.

Aquatic invasives can choke waterways, making it difficult to boat or swim.

Herbaceous Plant Control

- Act before seed set and senescence
- Dead head
- Dispose of properly – don't compost!
- Remove entire plants with all roots



Woody Plant Control



- Mechanical

- Repeated cutting
- Remove all roots
- Careful disposal
- Repair disturbed area
- Weed wrench



- Chemical

- Read label carefully
- Glyphosate (Roundup) or Trichlopyr (Garlon)
- Prevents resprouting
- Often most cost effective



Celastrus orbiculatus
Pleasant Valley, N.S.
Danok, MA
July 5, 2000
E.A. Reznicek



Oriental Bittersweet
Celastrus orbiculatus

Oriental Bittersweet

- Identification
 - Bright orange/red fruit borne along the stems
 - Alternate leaves (yellow in fall)
 - Roots are bright orange
- Spread
 - Large # of seeds
 - Bird dispersed
 - Suckers and fragments
- Management
 - Cut stump treatment



NATIVE Look-A-Like

American bittersweet (*Celastrus scandens*)



Terminal Inflorescence (fewer seeds)

Buckthorns

Frangula alnus, *Rhamnus cathartica*



UGA1334004

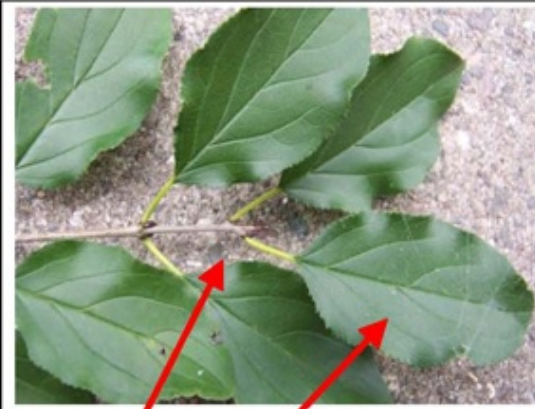
Glossy Buckthorn (*Frangula alnus*)

- Identification
 - Alternate leaves
 - No spines on stems
 - Flowers and fruit occur at the same time
- Spread
 - Prolific fruit- seeds dispersed by birds/animals
 - Fruit floats for 9-16 days
 - Rapid growth
- Management
 - Weed wrench
 - Cut stump treatment



Common Buckthorn (*Rhamnus cathartica*)

- Differences from Glossy Buckthorn
 - Leaves nearly opposite; edged with small teeth
 - Semi-sharp spine on twigs
 - Inner bark is orange
 - Fruit ripens later
 - Seeds viable for 2 years
 - More shade tolerant



Glossy leaves with deep, prominent leaf veins. Leaf edged with small teeth



(C) 2002, Gary Fewless

Similar to Common Buckthorn, leaves extremely glossy with deep veins and leaf margin is smooth, without teeth





Japanese Knotweed
Fallopia japonica

Japanese Knotweed

- Identification
 - 3 to 10 feet tall
 - Round hollow stem
 - Fruit - papery and winged
- Spread
 - Reproduces via rhizomes
- Management
 - Solid mulch
 - Mowing
 - Goats
 - Need to continuously control



Garlic Mustard

Alliaria petiolata



Garlic Mustard

- Identification
 - Strong garlic odor
 - Heart shaped leaves
 - 4 parted white flower (crucifer)
 - Plants dieback in June
- Spread
 - Exclusively by seed
- Management
 - Hand pulling
 - Herbicide
 - Possible biocontrol



Multiflora Rose

Rosa multiflora



Multiflora Rose



- Identification
 - Alternate leaves with stipules
 - Thorns!!!
 - Clusters of fragrant white flowers
 - ¼" egg shaped rosehips
- Spread
 - Prolific seed dispersed by birds
 - Root Sprout
 - Layering
- Management
 - Rose rosette disease
 - Spot treatment with herbicide

Japanese Barberry

Berberis thunbergii

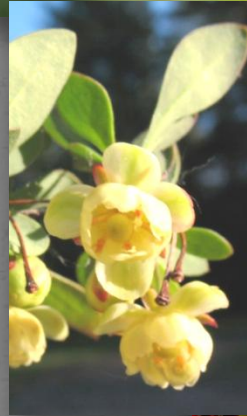
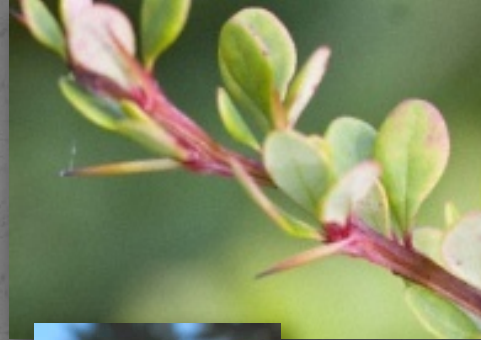


5379540

Japanese Barberry

- Identification

- Small spatulate leaves
- Sharp spines at leaf base
- Yellow spring flowers
- Red fruits



- Spread

- Prolific Seeds
 - High germination rate
 - Eaten by wildlife
- Root Sprout
- Layering



- Management

- Hand pulling isolated plants
- Foliar spray, cut stump, basal bark treatments

Next Steps and Opportunities

Act to prevent the spread of invaders while most of our natural systems are still in good condition.

- Prevention
- Early Detection / Rapid Response
- Control, Management, Restoration



Protecting native species

Prevention

- Public Outreach/Education
- Awareness
- Best practices (e.g. don't move plant material – including firewood)



**ATTENTION
CAMPERs**
Don't Move Firewood!



Early Detection / Rapid Response

- Keep alert; survey
- Collect suspect specimens or take photos
- Note location and REPORT



Control, Management & Restoration

- Know the species and life cycle
- Ask professionals for best management strategies
- Don't give up



Positive Spin

- Value in these species?
 - Food
 - Art



Resources

Invasive Forest Pests: www.maine.gov/forestpests

Invasive Agricultural Pests: www.gotpests.org

Invasive Plants:

- www.maine.gov/dacf/mnap/features/invasive_plants/invasives.htm
- www.gobotany.newenglandwild.org/
- www.vtinvasives.org/
- www.nps.gov/plants/alien/factmain.htm