LEAF-FEEDING INSECT PESTS OF WOODY PLANTS

IDENTIFICATION, BIOLOGY, AND MANAGEMENT

Introduction

- Pest Identification
- Pest significance
- Pest Biology
- Pest Management

Leaf-Feeing Insect Pests

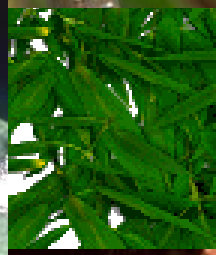
- “Webs and Tent-Makers”
- Consumers
- Skeletonizers

Leaf-Feeding Insect Pests

- Leafminers
- Notchers

Eastern Tent Caterpillar

- Preferred hosts:
  - Crabapple
  - Peach
  - Plum
  - Cherry



- Overwinters as egg mass

- **Appears in early spring**

Eastern Tent Caterpillar

- **Tents form in main branch crotches**
- One generation/year
- Completely defoliation may result

Pest Management

- **Prune** out tents early
- Chemical insecticides

Fall Webworm

- **Form webs on branch tips**
- Broad host range
- **Common in late summer**

Fall Webworm

- One generation/year
- Larvae are hairy and straw colored

Pest Management

- Prune out **webs**

- Chemical insecticides

Mimosa Webworm

- Host specific on honeylocust

- Two generations/year
- Overwinters as pupa

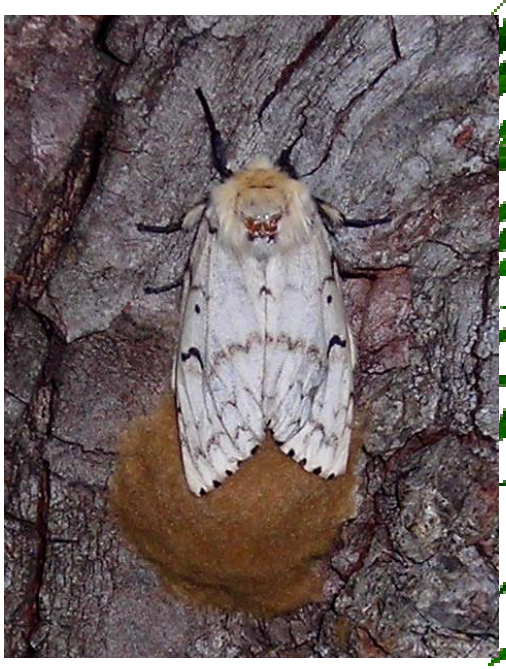
Mimosa Webworm Nests on Honeylocust

Mimosa Webworm

- Webs the leaflets together
- Complete tree defoliation may result

Spongy Moth

- Entered the U.S. in late 1860's from Europe
- Major defoliator of **forest and shade trees**
- **Preferred host is oak**
- Overwinters as egg mass

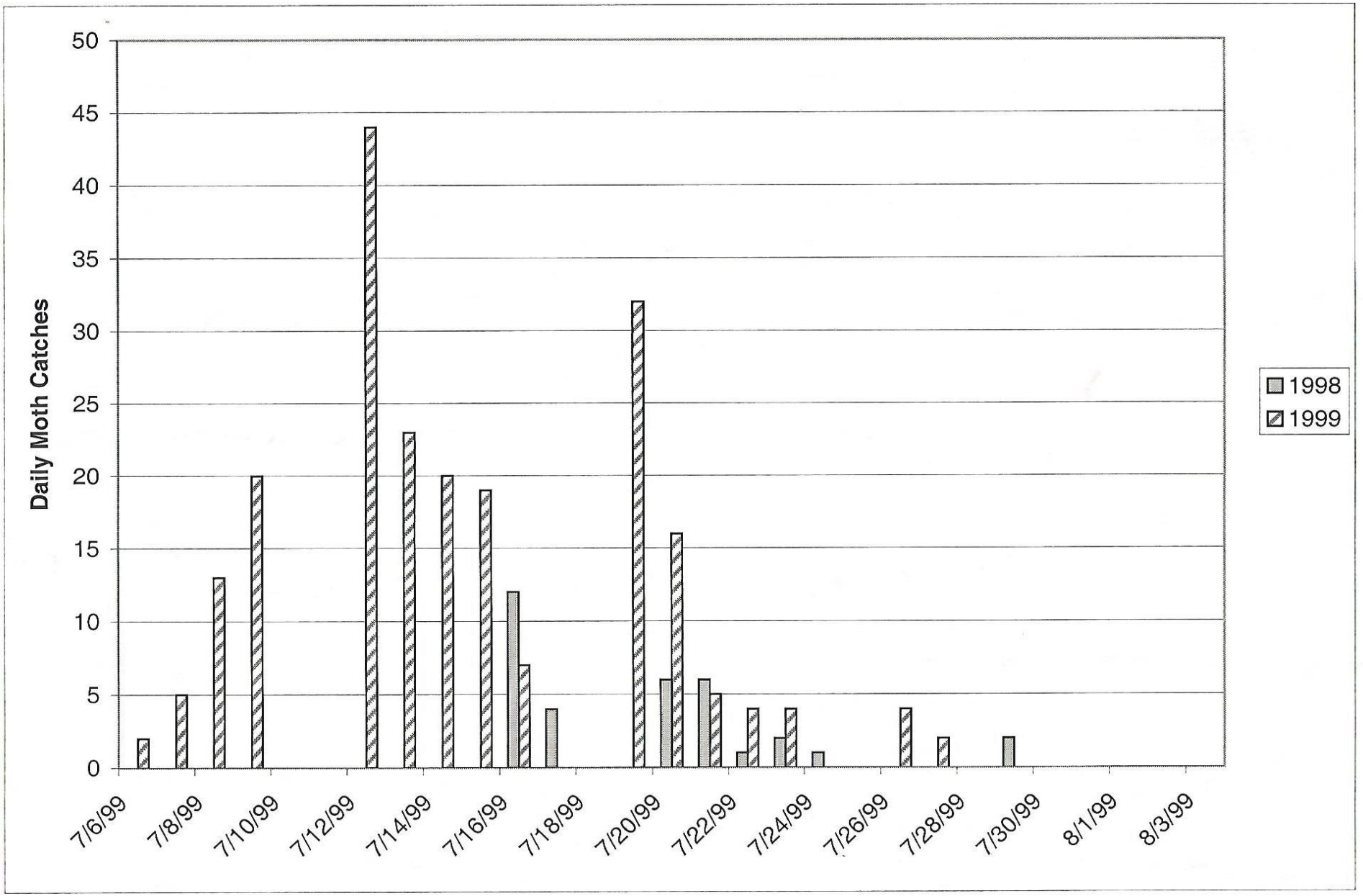


Spongy Moth Life Cycle

Spongy Moth Larvae

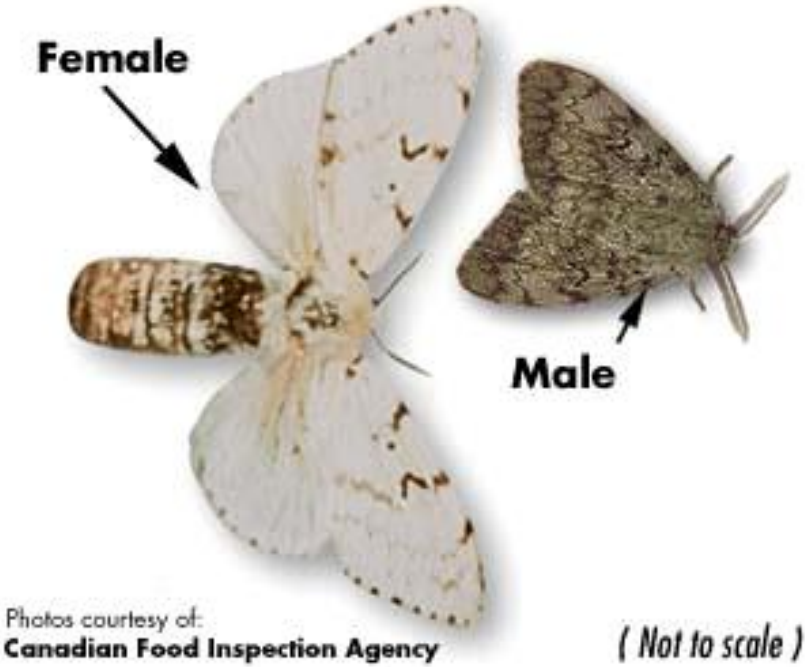
- Larvae are hairy
- Have 6 pairs of **red dots** and 4 pairs **blue** dots on back

Adult Male Gypsy Moth Catches
The Morton Arboretum
1998 - 1999

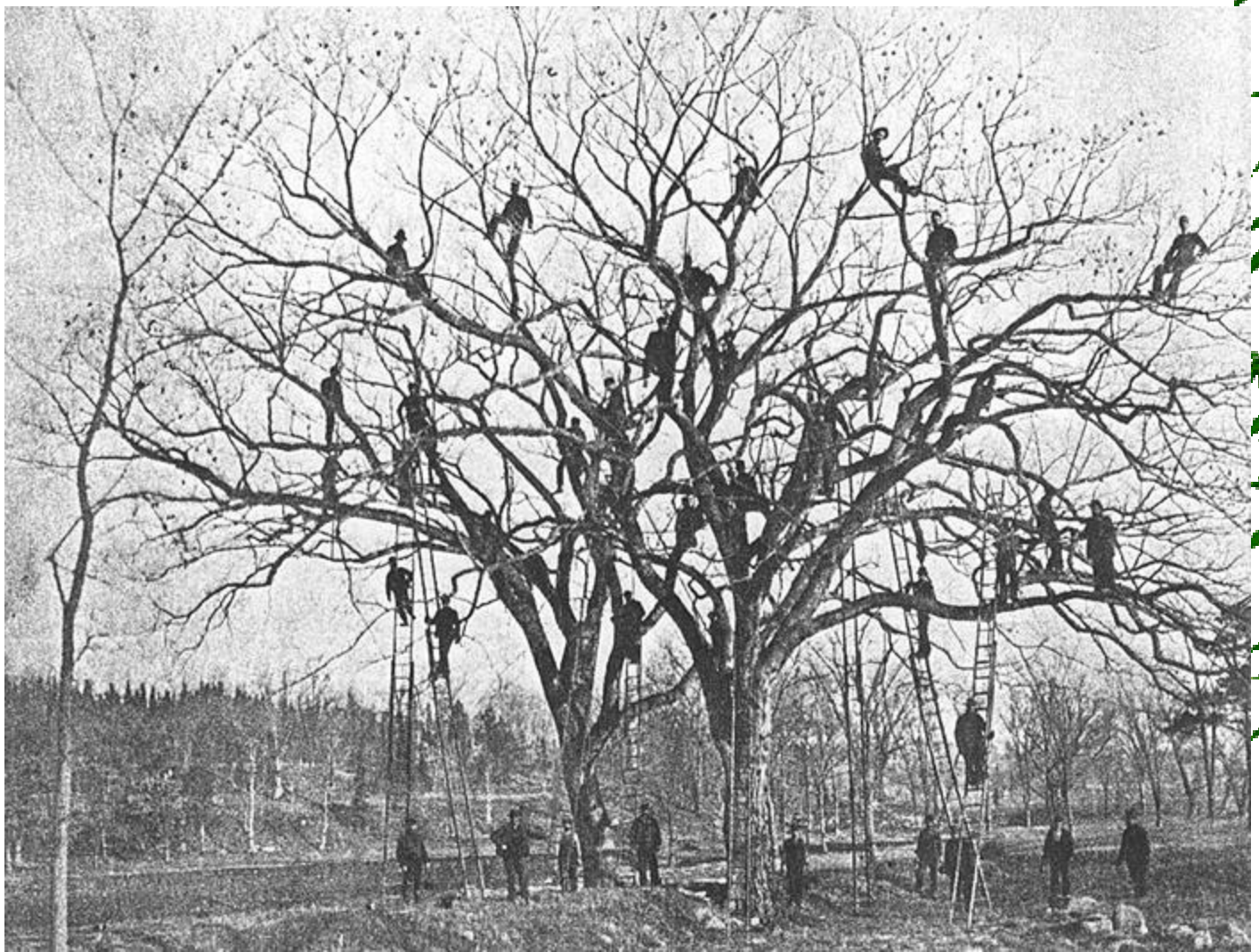


Spongy Moth Adults

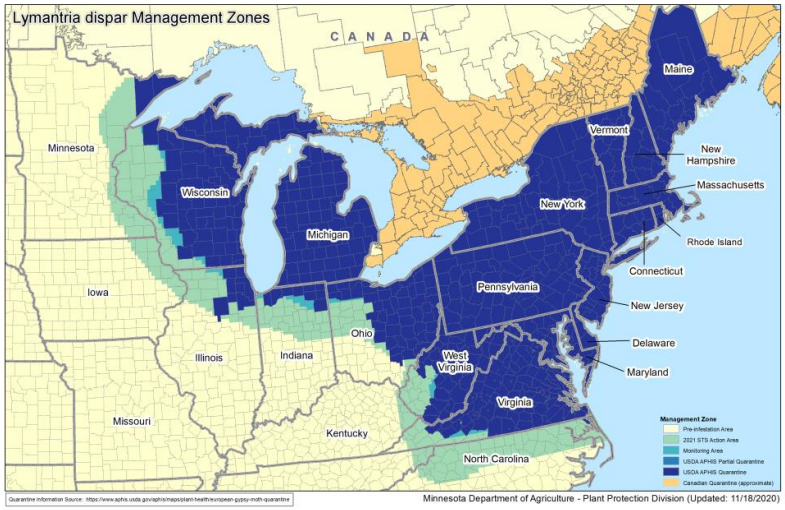
- One generation per year

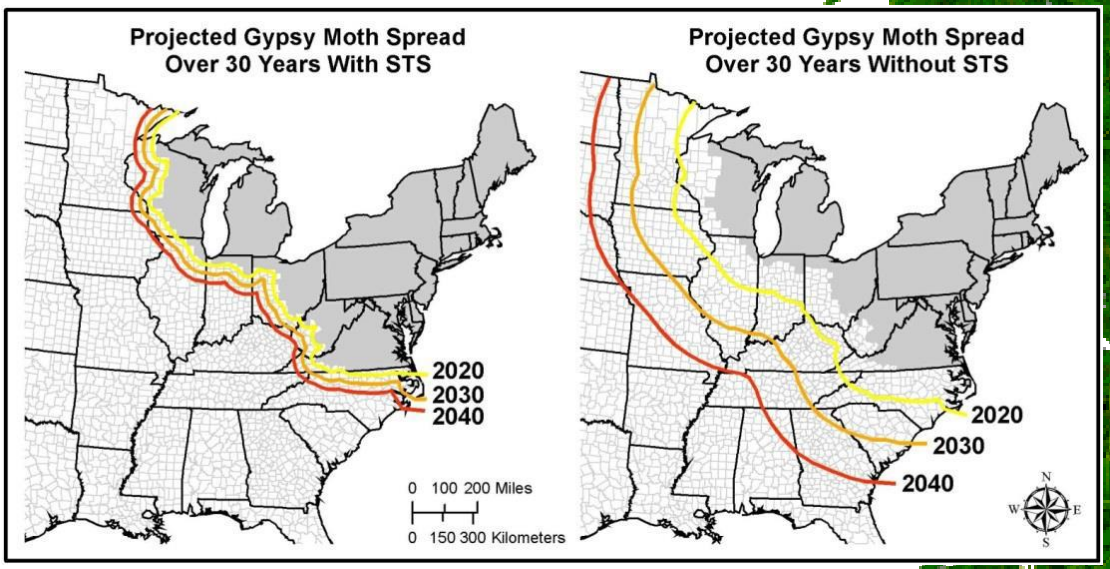


“Early Slow the Spread Program”

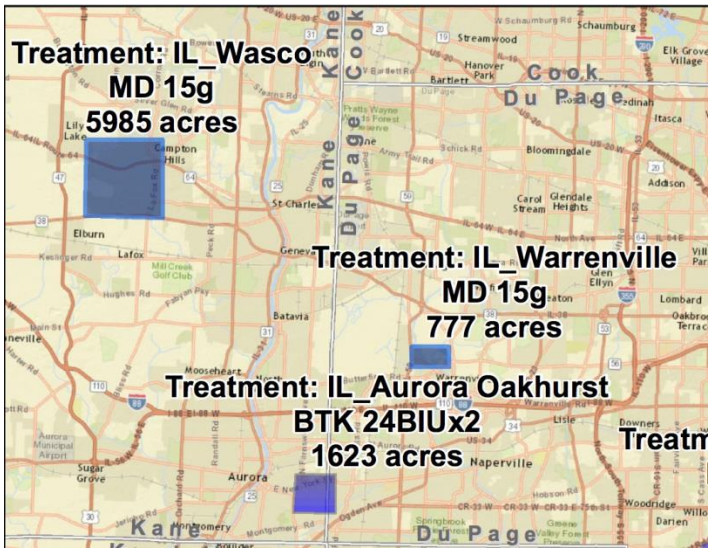


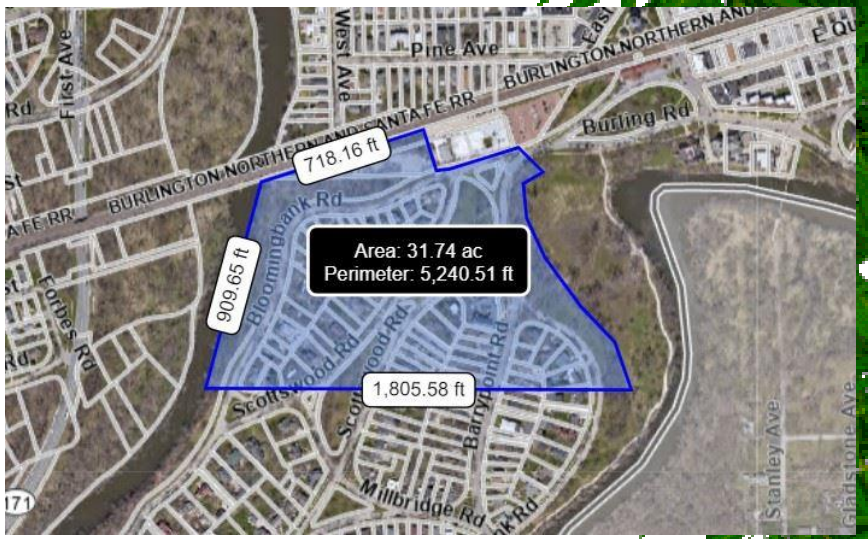
Spongy Moth Slow the Spread (STS) Program





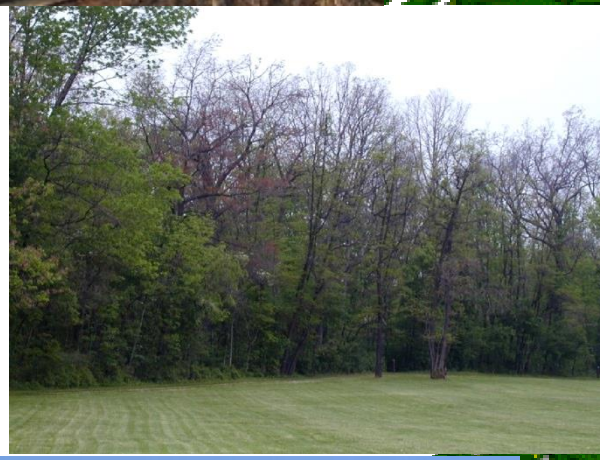
Spongy Moth STS in Illinois





Spongy Moth Management

- Populations somewhat regulated by cultural and biological controls
- Sprays with **pheromone flakes**
- Chemical sprays are used during **outbreaks**
- **Host Plant Resistance (HPR) or use of less susceptible tree species**



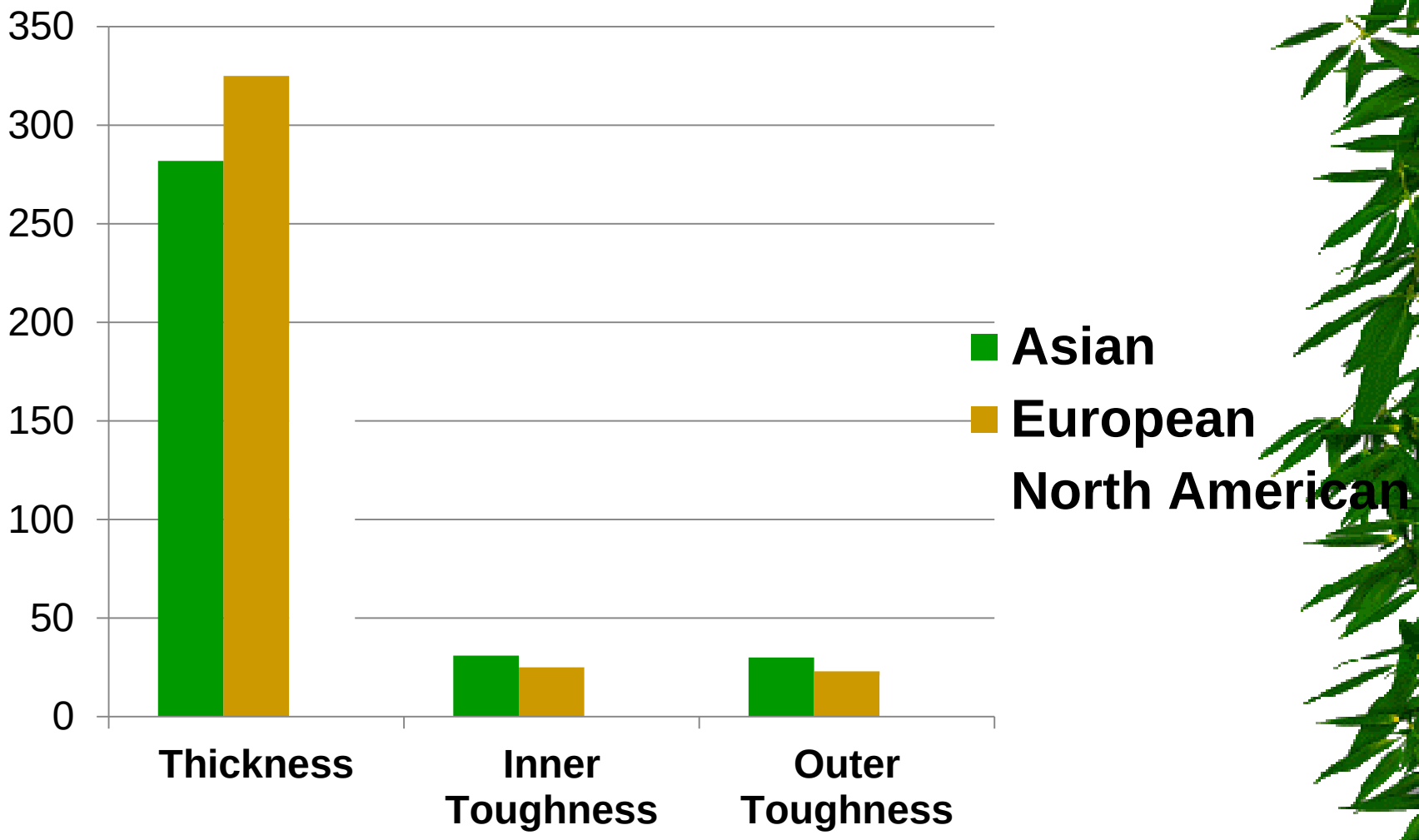
Leaf thickness, leaf toughness of Asian, European, and North American Elms

Taxa	Thickness[1] (microns)	Inner Toughness (g)	Outer Toughness (g)
Asian[2]	**282b**	**30.7b**	**29.7b**
European[2]	**325b**	24.9a	23.3a
North American	198a	25.3a	20.7a
Significance:	***F*=70.0 *P<0..001***	***F*=31.1 *P*<0.001**	***F*=39.1 *P*<0.001**

[1]Values within a column followed by the same letter are not significantly different (P<0.05; Dunn's Test).

[2]Includes simple and complex Eurasian hybrids

Leaf thickness and toughness of Asian, European, and North American Elms



Hornbeams (*Carpinus*) less susceptible to feeding by Spongy Moth and Japanese Beetle (Dirr, 2009)

- **Japanese Beetle**
- Yeddo Hornbeam *(Carpinus tschonoskii*)
- American x Korean Hornbeam hybrid
  - (*Carpinus caroliniana* x C. *coreana*)
- **Spongy Moth**
- Korean Hornbeam *(C. coreana)*
- *C. fargesii*
- Loose-flower Hornbeam *(C. laxiflora)*
- American x Oriental Hornbeam hybrid
  - (*C. caroliniana* x *C. orientalis*)

Elms less susceptible to feeding by Spongy Moth and Japanese Beetle (Dirr, 2009)

- **Japanese Beetle**
- ‘Frontier’ ‘Homestead’ ‘New Horizon’ ‘Pioneer’ ‘Patriot’, ‘Accolade
- ‘Triumph’ ‘Prospector’ ‘New Harmony’
- *U. parvifolia* *Z. serrata* (‘Green Valley’ and ‘Village Green’)
- **Spongy Moth**
- ‘Frontier’ ‘Homestead’ ‘New Horizon’
- ‘Pioneer’ ‘Patriot’ ‘Regal’
- ‘Triumph’ ‘Vanguard’ ‘Jefferson’
- ‘Liberty’ *Zelkova serrata, schneiderana, sinica*

European Pine Sawfly

- Preferred hosts are Scots and mugho pines

- **Larvae resemble caterpillars**

European Pine Sawfly

- Consume the entire needle
- **Eat last year's growth**

Feeding Damage

- One generation/year
- Severe defoliation is possible

Pest Management

- Remove larvae by **hand-picking**
- **Chemical treatment** is most effective

Leaf Beetles

- Both larvae and adults feed on leaves
- Adults **chew holes** in the leaves
- Larvae “**windowpane**”the leaves

Leaf Beetles

- Hosts include willow, poplar, viburnum, and elm
- Multiple generations per year

Leaf Beetles

- Overwinter as adults in protected sites
- Heavily defoliated trees will appear **scorched**

Pest Management

- Host plant resistance
- Chemical insecticides
- **Trunk banding**
- Biological control

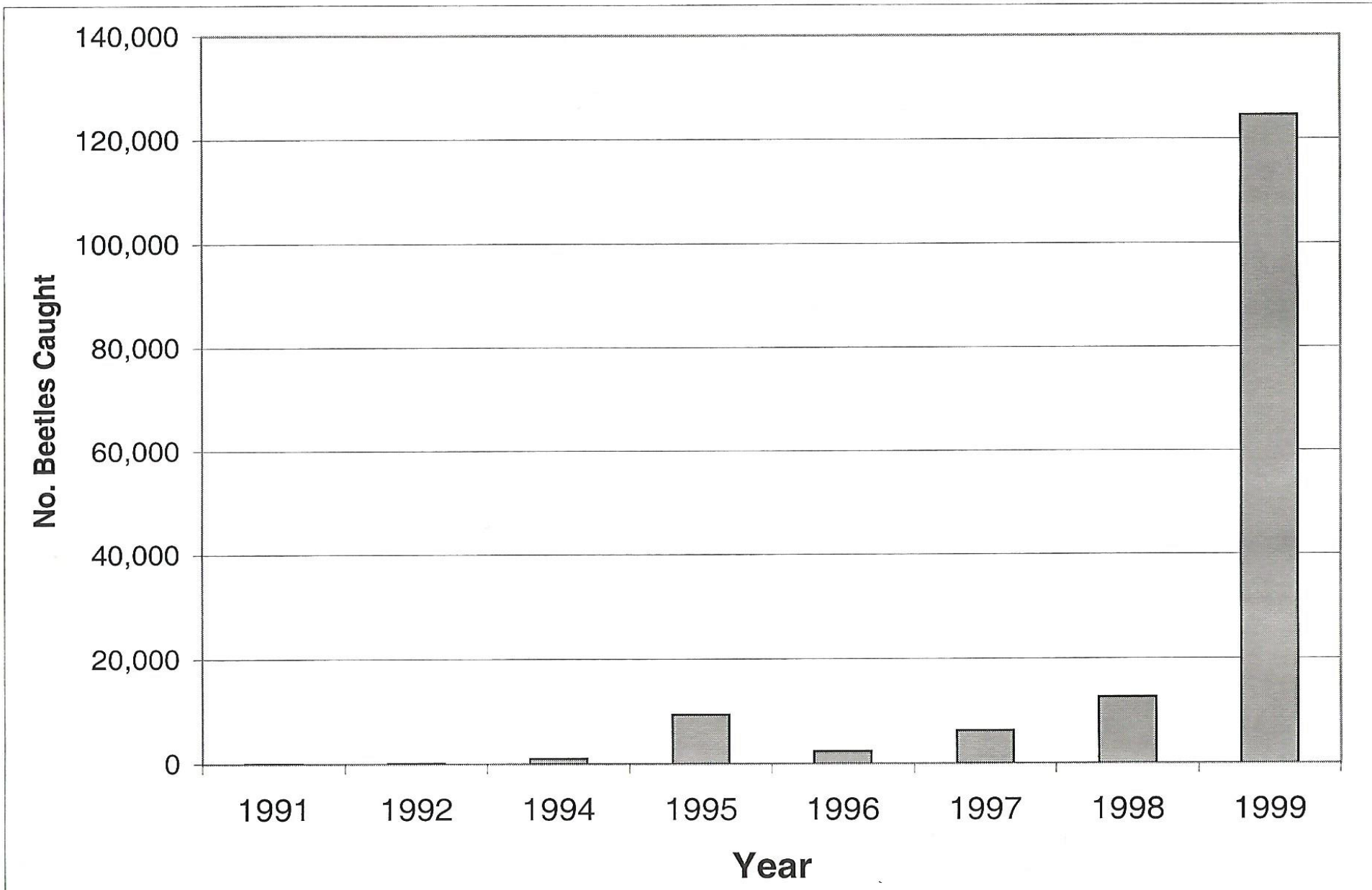
Japanese Beetle

- Broad host range
- Prefers hosts are Rose family, lindens, elms, and grape
- Adults **skeletonize** the leaves

Japanese Beetles
The Chicago Botanic Garden
1995 - 1999

Year	Date First Beetles Caught	Degree Days	Date of Peak Catch	Degree Days
1995	3-Jul	984	17-Jul	1375
1996	8-Jul	819	9-Aug	1474
1997	9-Jul	822	23-Jul	1162
1998	19-Jun	749	24-Jul	1605
1999	21-Jun	763	21-Jul	1479.5

Adult Japanese Beetle Catches
The Chicago Botanic Garden
1991 - 1999



Feeding Damage

Japanese Beetle

- Overwinters as a **grub**
- Grub feeds on turf roots
- One generation/year
- Adults active for 6-8 weeks

Pest Management

- **Host plant resistance**
  - Leaf chemistry and morphology may play a role

- **Chemical insecticides**
  - **Conventional insecticides**
  - **Bio-rational insecticides**

Pest Management

- **Hand-picking (Switzer and Cumming, 2014)**
  - Most effective for small-scale management
  - Most effective in evening
  - Reduces positive feedback between existing and future beetles
  - Female with heavy egg loads more likely to initiate aggregation
  - Males and females with lower egg loads join existing aggregations
- **Biological Control (Behle and Goett, 2016)**
  - Fungus *Metarhizium brunneum* was found to be effective against beetles grubs and adult beetles

Less Preferred Hosts

- *Acer negundo*
- *Acer rubrum*
- *Acer saccharinum*
- *Carya ovata*
- *Euonymus* spp.
- *Fraxinus americana*
- *Fraxinus pennslyvanica*
- *Ilex* spp.
- *Juglans cinerea*
- *Liriodendron tuliperfera*
- *Magnolia* spp.

Less Preferred Hosts

- *Morus rubra*
- *Populus alba*
- *Pyrus communis*
- *Quercus alba*
- *Quercus rubra*
- *Quercus velutina*
- *Rhododendron* spp.
- *Syringa vulgaris*
- *Abies* spp.
- *Taxus* spp.
- *Pinus* spp.
- *Picea* spp.

Preferred Hosts

- *Acer palmatum*
- *Acer platanoides*
- *Betula populifolia*
- *Hibiscus syriacus*
- *Juglans nigra*
- *Malus* spp.
- *Platanus acerifolia*
- *Populus nigra*

Preferred Hosts

- *Rosa* spp.
- *Sassafras albidum*
- *Sorbus americana*
- *Tilia americana*
- *Ulmus americana*
- *Ulmus procera*
- *Vitis* spp.

Japanese Beetle Traps

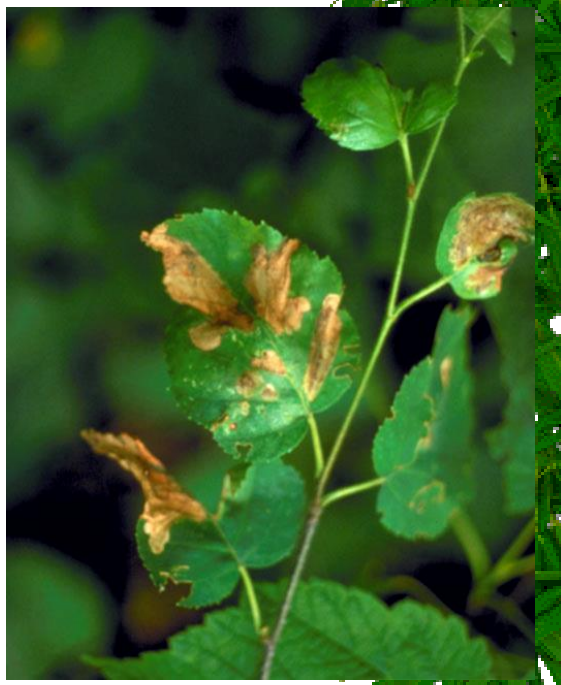
Leafminers

- Usually host specific
- Larvae **mine** the areas between the upper and lower leaf surfaces
- Mines appear as **blotch** or **serpentine**
- Usually causes **aesthetic** damage

Leafminers

- May have one or two generations/year
- Usually overwinter as larvae or **prepupae**
- Chemical management is the most effective treatment

Leafminers on Oak, Elm, and Arborvitae



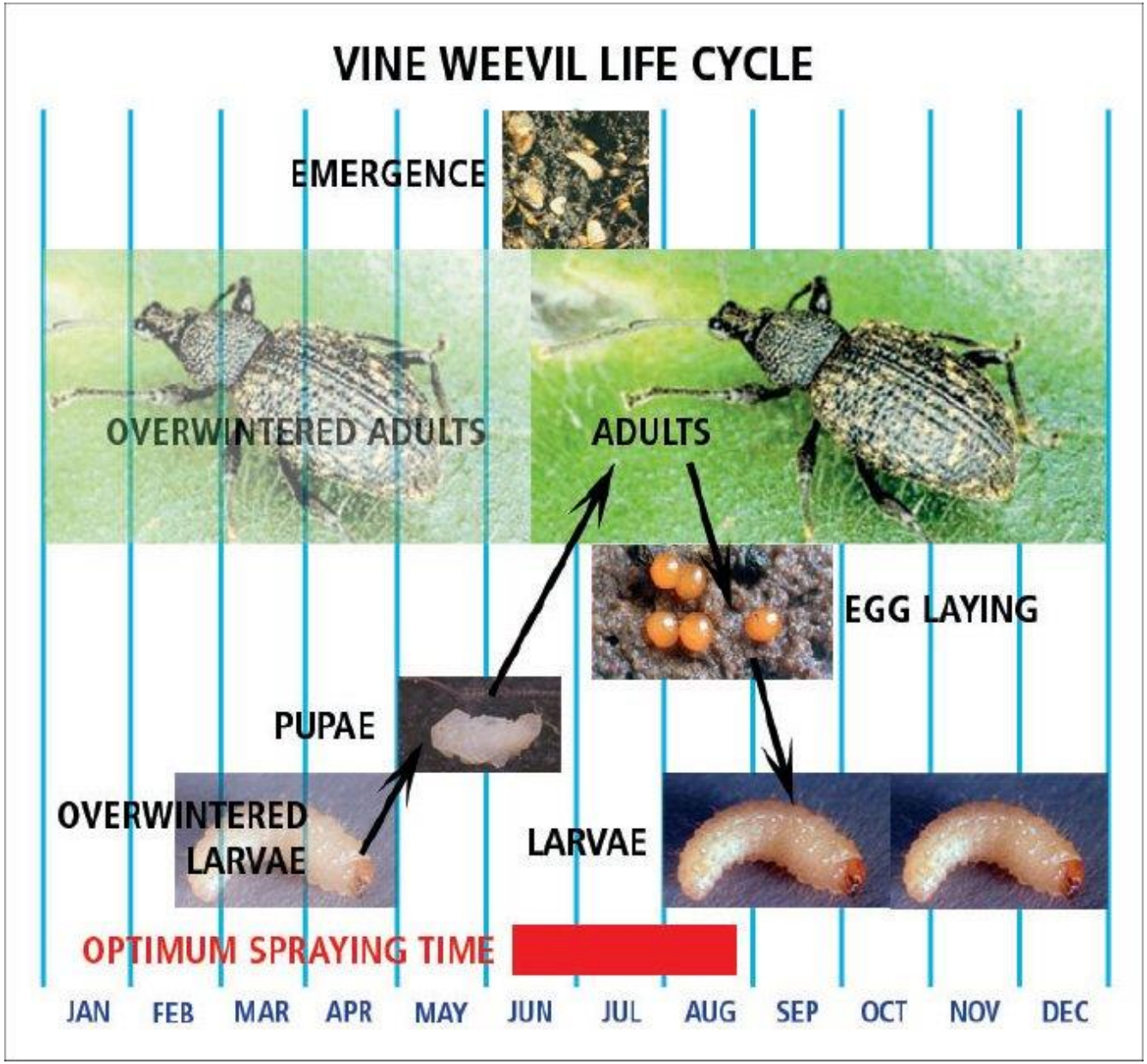
“Notchers”

- **Black vine weevil**
  - Adults **notch** leaf margins
  - **Adults feed at night**
  - **Adults not able to fly**
  - Reproduces **parthenogenetically**
    - No males in the population

“Notchers”

- **Black vine weevil**
  - **Larvae feed on roots**
  - One generation per year

Black Vine Weevil Lifecyle



Management of BVW

- Chemical insecticides
- Sanitation
- Larvae controlled using **entomopathogenic nematodes (EPNs)**
  - *Steinernema feltiae*
  - *Heterorhabditis bacteriophora*
- Study with EPNs on strawberries showed that EPNs controlled BVW for up to 4 years
- Portable listening devices used for insect detection in containers

“Notchers”

- **Leaf-cutter bees**
  - Harmless, no control needed
  - Cut **U-shaped notches** in leaf margins
    - 1/4-1/2 in.
  - Use leaf portions for nesting

SUMMARY

- Leaf-feeding insects rarely kill plants
- **Defoliation of evergreens can be lethal**
- Healthy plants can tolerate low to moderate defoliation

SUMMARY

- **Repeated heavy defoliation events may lead to:**
  - **Stress, Decline, and Death**
- Chemical management can be effective
- **Plant Health Care (PHC)** should be an integral part of the management plan


QUESTIONS
ANSWERS