

# Bark Beetles

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UPCLA Convention  
February 14, 2013



# Conditions that Promote Bark Beetles

- ❏ Drought
- ❏ Trees on dry, sloping sites
  - ❏ Tree stress
  - ❏ Dry soils in spring and fall
    - ❏ Supplemental irrigation is absent or inadequate
- ❏ Longer, hotter growing seasons
  - ❏ More bark beetle generations
- ❏ Warmer winters
  - ❏ Higher overwinter survival, more generations
- ❏ Cyclic populations of bark beetles
  - ❏ Established populations in an area
  - ❏ Spread from foci / sources



# Primary bark beetles in urban landscapes of Utah

- ❑ *Ips hunteri* & *I. pilifrons*
  - ❑ blue & Engelmann spruce
- ❑ *Ips pini*
  - ❑ ponderosa & lodgepole pine
- ❑ *Ips confusus*
  - ❑ pinyon & singleleaf pine
- ❑ **Banded elm bark beetle**
  - ❑ *Scolytus schevyrewi*
  - ❑ elm
- ❑ **Shot hole borer**
  - ❑ *Scolytus rugulosus*
  - ❑ apple, pear, cherry, hawthorn
- ❑ **Black walnut twig beetle**
  - ❑ *Pityophthorus juglandis*
  - ❑ black walnut



Ips have obvious spines on rear of outer wings



and a  
concave  
depression

Ips are tiny! 1/8 – 3/8 inch long

# Identification of common Utah bark beetles

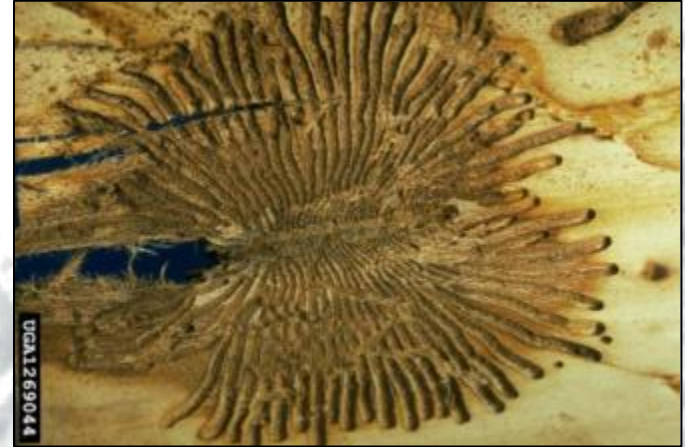
- ✧ UPPDL diagnostic support
  - ✧ ([www.utahpests.usu.edu/upddl](http://www.utahpests.usu.edu/upddl))
- ✧ Which tree species are affected?
  - ✧ A more complete list of common bark beetles in Utah:
    - ✧ Utah Pests Landscape Ornamental Fact Sheet: Bark Beetles
- ✧ Gallery construction design
  - ✧ Images in Bark Beetle Fact Sheet
- ✧ Appearance of adult beetles
  - ✧ Images in BB Fact Sheet

# Distinguishing characteristics of bark beetles



Spruce Ips galleries: “octopus arms”

How do they feed and tunnel in trees?



Elm bark beetle galleries: “radiating arms”



Adult Pinyon Ips hind end

Size, shape, and color & spine patterns on adults



Banded elm bark beetle adult

# www.utahpests.usu.edu

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Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory

## Bark Beetles


Ryan S. Davis, Arthropod Diagnostician, and Darren McAvoy, Extension Forestry Associate

**WHAT YOU SHOULD KNOW**

- Bark beetles are a significant cause of tree mortality in the forest and urban environment.
- To protect high-value trees around homesites, use preventative trunk sprays of carbaryl, permethrin, and bifenthrin prior to beetle flight.
- Soil- and trunk-applied systemic insecticides (e.g., imidacloprid and dinotefuran) do not sufficiently protect trees from bark beetle attack.

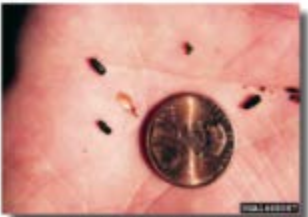
**BIOLOGY**

Bark beetles are one of the most destructive forest pests in the world. They are different than the larger longhorned and roundheaded/metallic woodboring beetles commonly infesting the inner wood of trees. The largest bark beetle, the red turpentine beetle (*Dendroctonus valens*), reaches only 8.3 mm in length. Because of their tiny size (Fig. 1), bark beetles are not effective tree killers as individuals. Instead, primary bark beetles work together, sending pioneer beetles to search for stressed or dying trees. When pioneer beetles find a weakened tree, they bore into and feed



**Fig. 2.** Typical top-down dieback pattern on pines infested by bark beetles<sup>1</sup>.

on the thin phloem layer just under the bark. As they feed, chemicals from their food are converted into attractive chemicals, signaling to other beetles of the same species that a suitable host was found. Beetles that detect the airborne chemicals will fly to the stressed tree, bore into the phloem, create a mating (nuptial) chamber, mate, and hollow-out a parental gallery laying eggs as they progress. Usually, many beetles attack the same tree in a short period of time allowing them to overcome its defenses (e.g., resin in pines). This is called mass attack. After egg hatch, immature beetles (larvae) (Fig. 12) begin feeding outward from the parental gallery, girdling the tree. This larval girdling is the same as killing a tree by deeply scoring its entire circumference with a knife or



**Fig. 1.** Average size of an adult bark beetle compared to a penny<sup>1</sup>.

# Ips galleries in conifers



Feed in cambium tissues just under bark;  
Center nuptial chamber, eggs are laid, &  
larval tunnels radiate out (Y-, H- or octopus-shaped arms)

# Ips bark beetles

- ✧ In forests, Ips are usually considered secondary invaders of already declining trees, infest slash piles after logging
- ✧ In the urban landscape, Ips are acting more like primary attackers
  - ✧ Conifer mortality
    - ✧ Spruce (blue & Engelmann), pines
  - ✧ Attack smaller diameter limbs at top of tree first
    - ✧ Tree death within 1-2 yrs
- ✧ Last upswing in cycle of urban Ips infestations was in mid 2000s
  - ✧ Correlated to drought cycle
  - ✧ Starting again?



Blue spruce attacked by  
*Ips hunteri*



# Ips: pioneers & mass attack

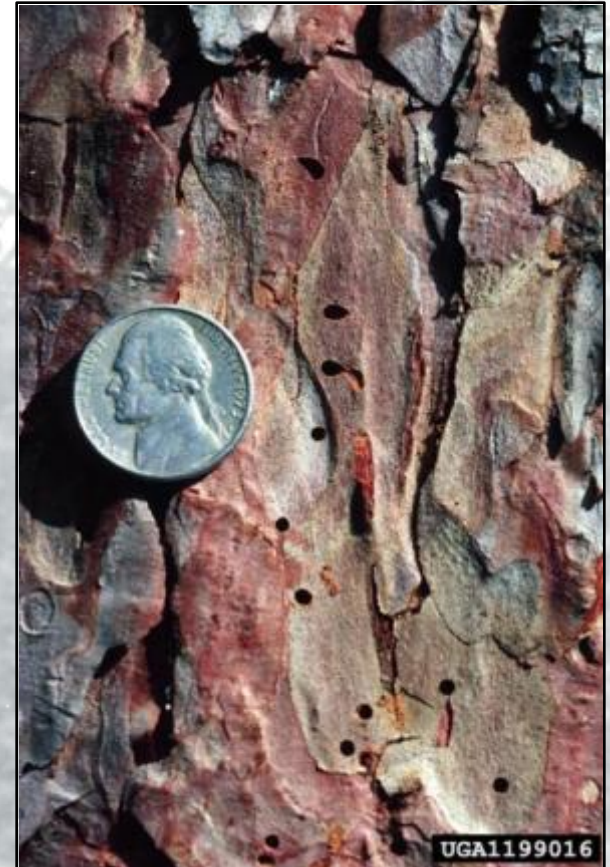
- ✘ Pioneer beetles – stressed trees
  - ✘ Bore in –convert sap chemicals to an aggregation pheromone
  - ✘ Signal others to join
- ✘ Attack trees in mass numbers
  - ✘ Overcome tree's natural defenses
    - ✘ pitch tubes
  - ✘ Adult flights synchronized
    - ✘ Spring – April (Wasatch Front)
    - ✘ Fall – late Sep to Oct
- ✘ Life cycle: 6-8 wk duration
  - ✘ Several generations within a tree at same time
  - ✘ Up to 5 generations/yr



Pitch tubes & boring dust on bark of pinyon pine

# Fatal attraction

- ⌘ Males bore in, release sex pheromone to attract female
  - ⌘ Nuptial gallery – larval galleries
- ⌘ Bark beetle galleries
  - ⌘ Disrupt transport of nutrients & water
  - ⌘ Girdles the tree
  - ⌘ Many bark beetles carry a fungus that inhibits water transport
- ⌘ New generation of adults emerge through “shotholes”



Ips adult exit holes

# Key Ips management strategy: Prevent tree stress

- ❏ Avoid dry planting sites
  - ❏ slopes, south-facing
  - ❏ fast-draining soils, inadequate irrigation
  - ❏ Provide deep irrigation
    - ❏ 2-4 inches water/month for established trees
- ❏ Avoid over-crowded plantings
- ❏ Avoid compacted soils
  - ❏ construction sites
- ❏ Prevent mechanical injuries
- ❏ Remove Ips-infested trees (foci)
  - ❏ remove infested wood
  - ❏ properly dispose: chip & dry, remove bark, burn



# Ips control: Insecticides

- ⌘ Preventive application
  - ⌘ when infested trees are in the neighborhood
- ⌘ Save trees infested  $\leq 30\%$ 
  - ⌘ Loss of central leader will permanently distort tree shape
- ⌘ Apply insecticide to entire bole & interior of lateral limbs
  - ⌘ Spring (April) before beetle flight
  - ⌘ Daily temps  $>50^{\circ}\text{F}$
  - ⌘ Kill beetles when chew thru insecticide-soaked bark
  - ⌘ Fall (late Sept – Oct)
- ⌘ High pressure ( $\geq 250$  psi), drenching spray to run-off, professional applicator & equipment
  - ⌘ Thorough coverage!

# Examples of effective insecticides

- ⊠ Carbaryl (carbamate)
  - ⊠ Carbaryl 4L, Sevin XLR
- ⊠ Bifenthrin (pyrethroid)
  - ⊠ Bifen XTS
  - ⊠ Onyx
- ⊠ Permethrin (pyrethroid)
  - ⊠ Astro
  - ⊠ Hi Yield 38 Plus<sup>Homeowner</sup>
- ⊠ 1-2 applications per year
- ⊠ To date, systemic insecticides have not shown good efficacy



# Sanitation: Treating infested wood

- ✘ Promptly remove wood from the landscape
  - ✘  $\geq 2$ -3 miles from host trees
- ✘ Check wood for live beetles
- ✘ Kill beetles within wood
  - ✘ Remove bark
  - ✘ Chip wood & spread to dry
  - ✘ Cover log pile with clear plastic
    - ✘  $>130^{\circ}\text{F}$  for a month (summer)
  - ✘ Burn wood



Ips pupa, larva, and adult within gallery tunnels



Cover infested logs with clear plastic to kill bark beetles with heat

# *Scolytus* spp.: Elm bark beetles



Banded elm bark beetle  
*Scolytus schevyrewi* (1/8 inch)



European elm bark beetle  
*Scolytus multistriatus* (1/16-1/8 inch)



Dying elm trees



Attack elm (American, Siberian, English, rock),  
*Prunus* spp., willow, Russian olive, possibly Zelkova

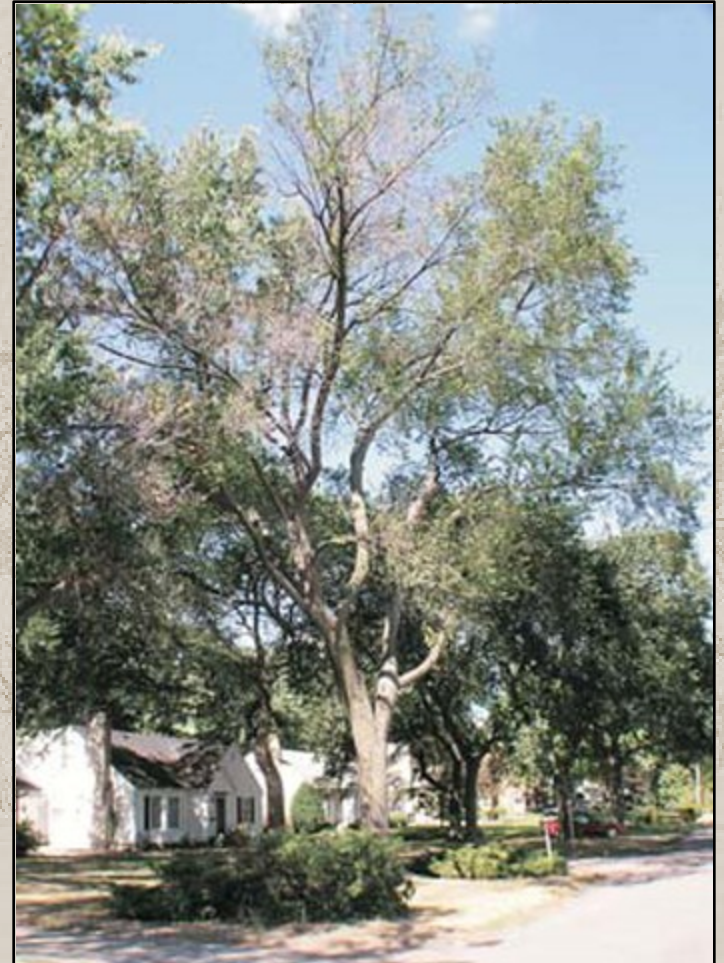
Vector Dutch elm disease (fungus)

Galleries with “radiating arms”  
External twig & branch crotch feeding



# Elm bark beetle & Dutch elm disease (DED) management

- ❏ DED resistant elm cultivars
  - ❏ 'Valley Forge', 'New Harmony', 'American Liberty', 'Princeton'
- ❏ Preventive insecticides
  - ❏ adult emergence: May-June (1-3 gens/yr)
  - ❏ canopy, limbs, and upper trunk
  - ❏ bifenthrin, cypermethrin, permethrin, carbaryl
- ❏ Prune out infected limbs
  - ❏ brown vascular tissue in limbs, twigs
- ❏ Sever root grafts between elm trees (fungus spread)





# Elm bark beetle & DED fact sheet



Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory

ENT-147-11 September 2011

## Elm Bark Beetles and Dutch Elm Disease

Ryan S. Davis, Arthropod Diagnostician

### DID YOU KNOW?

- Two major bark beetle species attack elm trees in Utah; both can transmit Dutch Elm Disease (DED), leading to tree death, decline, or chronic stress.
- Preventive treatments such as foliar insecticide applications, severing root grafts between trees, injectable fungicides, and proper pruning of affected areas can minimize transmission of DED.
- New, DED-resistant American elm cultivars are available for purchase; look for "Valley Forge" and "New Harmony" at your local nursery.

### INTRODUCTION

Bark beetles (Family Curculionidae, Subfamily Scolytinae) are some of the most devastating insect pests in the world. Closely related to weevils, there are almost 500 species of bark beetles in North America alone, each with unique host plants, habits, and life cycles. It is crucial to accurately identify a suspect bark beetle before you consider treatment options.

In Utah, trees in the genus *Ulmus* (elm) can be attacked by bark beetles carrying Dutch Elm Disease (DED) (*Ophiostoma ulmi* and *O. novo-ulmi*), leading to tree death, or chronic illness and stress. This fact sheet will help you recognize the two major elm-attacking beetles in Utah and develop a control strategy for the beetles and DED.

Of the three major elm-feeding bark beetles, the European elm bark beetle, *Scolytus multistriatus*, and the banded elm bark beetle, *Scolytus schevyrewi*, are the major vectors of DED in Utah. The elm bark beetle (*Hylurgopinus rufipes*), native to eastern and central United States, is also briefly discussed.

### THE ELM BEETLES

#### Banded Elm Bark Beetle

**Scientific Name:** *Scolytus schevyrewi*

**Range:** Utah and 22 other—mostly western and mid-western states—Russia, northern China, and central Asia.

**Hosts:** American elm (*Ulmus americana*), Siberian elm (*U. pumila*), English elm (*U. thomasi*), and rock elm (*U. procera*) in North America; in various elms (*Ulmus* spp.) in Rus-



Fig. 1. Banded elm bark beetle (*Scolytus schevyrewi*) adults feeding on elm branch branches can transmit DED. Notice the band pattern on the wings!

sia, China, and Asia; Russian olive, willows, woody plants in the pea family, and fruit trees in the genus *Prunus* are potential hosts.

**Identification:** Small beetle three-four mm long with black bands across the wings (usually apparent) (Fig. 1); from the side, the rear of the beetle appears to have a "finger nail" shape and spine.

**Life History:** Two to three generations per year in Utah with adult flight beginning in early spring (April), continuing throughout the growing season.

#### European Elm Bark Beetle

**Scientific Name:** *Scolytus multistriatus*

**Range:** Contiguous United States into Canada; Europe.

**Hosts:** American elm (*Ulmus americana*), Siberian elm (*U. pumila*), other elms (*U. pumila*), and possibly trees in the genus *Zelkova*.

**Identification:** Small beetle two to three mm long without black bands across the wings (as compared to banded elm bark beetle); from the side, the rear of the beetle appears to have a "finger nail" shape and a spine (Fig. 2).

**Life History:** Adult emergence roughly coincides with spring elm leaf-flush (mid May); there are 2-3 generations per year in Utah.

[www.utahpests.usu.edu](http://www.utahpests.usu.edu)  
Fact sheets:  
Insects – Landscape Orn.

# Shothole Borer: *Scolytus rugulosus*

Hosts: *Prunus* spp.  
cherry, apple, pear, hawthorn  
< 1/16 inch diam holes  
1/8 inch long beetle



Entry holes with sap

Exit holes: "shothole"



- Cut out infested limbs
- Keep trees healthy
- Attack stressed trees
- Insecticides at peak adult flights:  
spring & fall

# Walnut twig beetle

## *Pityophthorus juglandis*

- ❏ Vectors tree-killing fungus
  - ❏ Thousand Cankers Disease
- ❏ Primary host: black walnut
  - ❏ can attack & kill other walnuts
- ❏ Primarily attack limbs  $\geq$   $\frac{3}{4}$  inch diam
- ❏ Colorado State Univ. Pest Alert (online)
- ❏ USU Fact Sheet
  - ❏ [www.utahpests.usu.edu](http://www.utahpests.usu.edu)

### PEST ALERT

#### Walnut Twig Beetle and Thousand Cankers Disease of Black Walnut

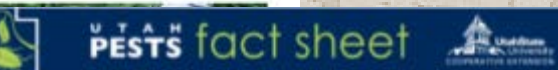
For at least the past decade, an unusual decline of black walnut (*Juglans nigra*) has been observed in several western states. Initial symptoms involve a yellowing and thinning of the upper crown, which progresses to include death of progressively larger branches (Figure 1). During the final stages large areas of foliage may rapidly wilt. Trees often are killed within three years after initial symptoms are noted. Tree mortality is the result of attack by the walnut twig beetle (*Pityophthorus juglandis*) and subsequent canker development around beetle galleries caused by a fungal associate (*Geosmithia morbida*) of the beetle (Figure 2). The name for this insect-disease complex is *thousand cankers disease* (TCD) of walnut.



Figure 1. Rapidly wilting black walnut in the final stage of thousand cankers disease.



Figure 2. Walnut twig beetle (*Pityophthorus juglandis*) on a branch.



#### Thousand Cankers Disease of Walnut (*Geosmithia morbida*)

Charles Hochwiler, Extension Plant Pathologist • Malena Iacono, PhD Project Leader

#### What you should know

- Thousand cankers disease is caused by the fungus *Geosmithia morbida*.
- It is transmitted by the walnut twig beetle (*Pityophthorus juglandis*).
- Once symptoms are visible, trees can die within 2 to 3 years.

#### INTRODUCTION

Thousand cankers is a newly recognized disease of walnuts, caused by a fungus (*Geosmithia morbida*) that is transmitted by the walnut twig beetle (*Pityophthorus juglandis*, Fig. 1). The beetle is endemic to the native range of Arizona walnut (Arizona, New Mexico, and Chihuahua, Mexico), and was first identified in Utah in 1986. Recognized mortality of black walnut in the north 2000s in Colorado and Utah led to the discovery of the collar-girdler complex. The name of the disease comes from the numerous necrotic lesions (cankers, Figs. 4c and 5) found on the cambium of attacked trees (Hochwiler et al. 2009). The fungus kills black walnut trees (Fig. 2) often within 2 years of the development of the first symptoms (Drenth and Taylor 2006).

#### HOSTS

Black walnut (*Juglans nigra*) and black walnut hybrids are very susceptible to *Geosmithia*. California walnut (J. hindsii), J. californica and Persian walnut (J. regia) are slightly susceptible. Cankers do not seem to form on eastern walnuts (J. major) (Drenth and Taylor 2006).

#### SYMPTOMS

It may take several years of insect and fungal attack before symptoms are visible, starting with yellowing leaves and thinning leaf crown. As the disease progresses, foliage with larger cankers die, and eventually the tree dies (Fig. 3) (Hochwiler et al. 2009). Visible exit holes caused by the twig beetle can be found on the trunk (Fig. 3).



Fig. 4. Walnut twig beetle (*Pityophthorus juglandis*) on a branch.



Fig. 5. 100-year old black walnut killed in northern Utah.



Fig. 6. Exit holes caused by the walnut twig beetle.

# Thousand Cankers Disease Symptoms

- ⌘ Yellowing & thinning of upper crown
- ⌘ Death of progressively larger branches
- ⌘ Rapid wilt of foliage (final stages)
- ⌘ ~ 3 yrs to kill trees



*Geosmithia morbida* cankers and black walnut limb death

# Distribution of walnut twig beetle & thousands cankers disease

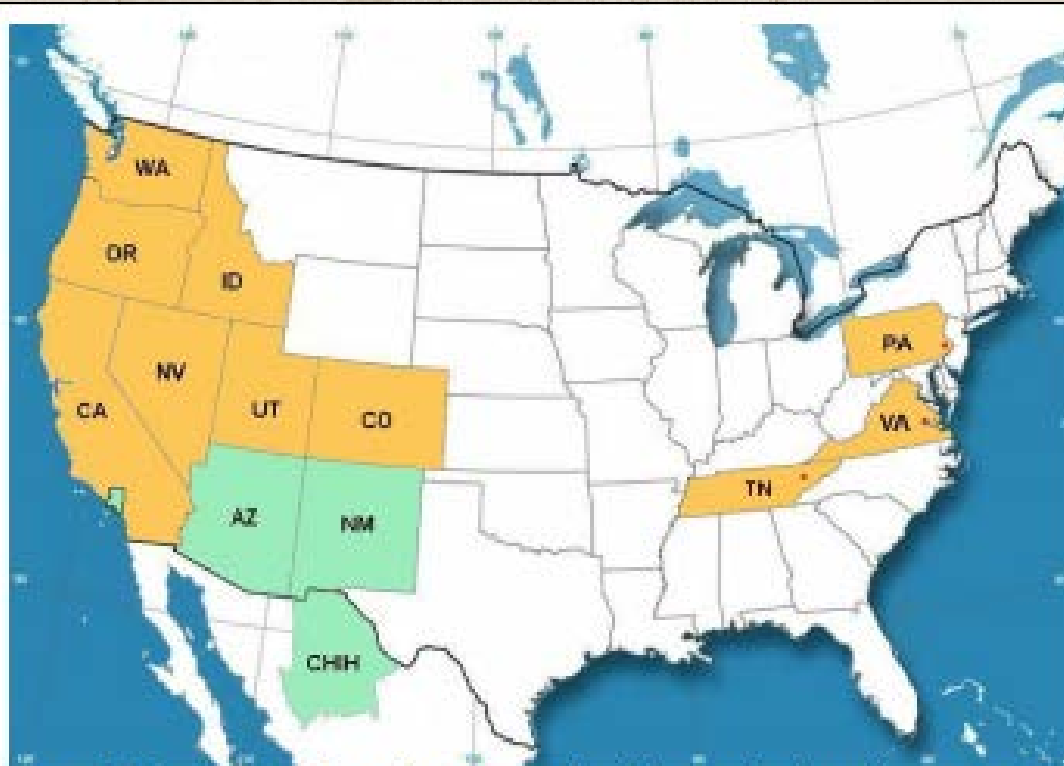


Figure 3. Distribution of the walnut twig beetle and thousand cankers disease. In green are states and the California county of Los Angeles with records of the species prior to 1960. States in orange have reported the insect since 1988. The recent (2010-2011) records from states east of the Mississippi are presently known only from limited areas: Tennessee/Knox County and surrounding areas; Virginia/Richmond; and Pennsylvania/Bucks County.

- Black walnut tree death in Utah first noticed in early 1990's
- First UT WTB specimen – 1988
- Arizona walnut, *Juglans major*, may be native host for WTB
- Earliest specimens: 1898 (NM)



Walnut twig beetle adult ~ 1/16 inch, yellowish-brown color



# Monitoring walnut twig beetle

- ⌘ USFS Entomology Team developed pheromone trap
- ⌘ Identified aggregation pheromone
- ⌘ Pheromone-baited funnel trap
- ⌘ Trapped WTB from Richmond (N) to Cedar City (S)
- ⌘ Contech pheromone lure & funnel trap available from Forestry Distributing
  - ⌘ [www.forestrydistributing.com](http://www.forestrydistributing.com)



Place traps ~10 ft high  
near host trees

# Bark Beetle Take-Home Points

- ⌘ Prevention!!
  - ⌘ Maintain tree health / prevent stress
    - ⌘ Planting site, irrigation, protection
- ⌘ Sanitation!
  - ⌘ Promptly prune affected limbs or remove infested trees
  - ⌘ Properly dispose of infested wood
    - ⌘ Chip, tarp, burn, dispose  $\geq 3$ -4 miles
- ⌘ Insecticides (preventive)
  - ⌘ Timed for spring and fall (adult flight periods)
  - ⌘ Good coverage, high pressure, soak bark



Mountain pine beetle is devastating Uinta Mountain pines