

National Park Service  
U.S. Department of Interior

Eastern Rivers and Mountains Network

# Early Detection of Invasive Species

## Surveillance Monitoring Field Guide

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Supplement 1  
May 2011

**Supplement 1, May 2011**

## **Supplement 1, May 2011**

### **Purpose of this Field Guide:**

This guide was designed as part of the Eastern Rivers and Mountains (ERMN) and Northeast Temperate (NETN) Networks Early Detection of Invasive Species Surveillance Monitoring and Rapid Response monitoring protocol. The purpose is to assist National Park Service (NPS) employees, contractors, and citizen scientists to detect incipient populations of targeted invasive species before they become widely established. The taxa presented in this guide are a subset of larger target species lists that were produced for each park in the above mentioned networks. Taxa already present in the USDA Forest Service “Invasive Plants Field and Reference Guide: An Ecological Perspective of Plant Invaders of Forests and Woodlands Field Guide” were not duplicated. The overall format of this guide follows that of the USDA Forest Service Guide and allows for supplementation with individual taxon cards from the Forest Service guide. As new park species threats arise, new ISED cards will be produced.

**This work is in progress; information and comments from the users of this guide are welcome.**

## Species List

### By Scientific Name

#### Pest

- Adelges tsugae* -- hemlock woolly adelgid
- Agrilus planipennis* -- emerald ash borer
- Anoplophora glabripennis* -- Asian long-horned beetle
- † *Pityophthorus juglandis/Geosmithii* sp. -- Thousand Cankers Disease
- \* *Pyrrhalta viburni* -- viburnum leaf beetle
- Sirex noctilio* -- sirex woodwasp

#### Herbs

- Cardamine impatiens* -- narrowleaf bittercress
- \* *Lespedeza cuneata* -- Chinese lespedeza
- Lythrum salicaria* -- purple loosestrife
- Oplismenus hirtellus* ssp. *undulatifolius* -- wavyleaf basketgrass

#### Vines

- \* *Ampelopsis brevipedunculata* -- Amur peppervine
- Dioscorea oppositifolia* -- Chinese yam
- \* *Humulus japonicus* -- Japanese hop

#### Shrubs

- Frangula alnus* -- glossy buckthorn
- \* *Rhodotypos scandens* -- jetbead
- \* *Viburnum dilatatum* -- linden arrowwood

#### Trees

- \* *Aralia elata* -- Japanese aralia
- \* *Phellodendron amurense* -- Amur corktree

#### Aquatics

- \* *Didymosphenia geminata* -- *didymo*
- \* *Trapa natans* -- water chestnut

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\* Denotes new species added in Supplement 1, May 2010.  
† Denotes new species added in Supplement 1, May 2011.

## Supplement 1, May 2011

### Species List By Common Name

#### Pest

- Asian long-horned beetle -- *Anoplophora glabripennis*
- emerald ash borer -- *Agrilus planipennis*
- hemlock woolly adelgid -- *Adelges tsugae*
- sirex woodwasp -- *Sirex noctilio*
- † Thousand Cankers Disease -- *Pityophthorus juglandis/Geosmithii* sp.
- \* viburnum leaf beetle -- *Pyrrhalta viburni*

#### Herbs

- \* Chinese lespedeza -- *Lespedeza cuneata*
- narrowleaf bittercress -- *Cardamine impatiens*
- purple loosestrife -- *Lythrum salicaria*
- wavyleaf basketgrass -- *Oplismenus hirtellus* ssp. *undulatifolius*

#### Vines

- \* Amur peppervine -- *Ampelopsis brevipedunculata*
- Chinese yam -- *Dioscorea oppositifolia*
- \* Japanese hops -- *Humulus japonicus*

#### Shrubs

- glossy buckthorn -- *Frangula alnus*
- \* jetbead -- *Rhodotypos scandens*
- \* linden arrowwood -- *Viburnum dilatatum*

#### Trees

- \* Amur corktree -- *Phellodendron amurense*
- \* Japanese aralia -- *Aralia elata*

#### Aquatics

- \* didymo -- *Didymosphenia geminata*
- \* water chestnut -- *Trapa natans*

\* Denotes new species added in Supplement 1, May 2010.

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# VIBURNUM LEAF BEETLE

## [*Pyrrhalta viburni* Paykull]



Fig.1

UGA 9005048

**Problem:** Native to most of Europe, the viburnum leaf beetle (VLB) (Fig. 1) feeds on, defoliates and can eventually kill viburnum shrubs.<sup>1,3,5</sup> VLB only feeds on Viburnum species.<sup>1,4</sup> Susceptible species include: the *V. dentatum* complex (arrowwood viburnums), *V. opulus* (European cranberry bush), *V. opulus* var. *americana* (American cranberry bush), and *V. rafinesquianum* (Rafinesque viburnum), and to a lesser extent, *V. lantana* (wayfaringtree viburnum), *V. lentago* (nannyberry), *V. prunifolium* (blackhaw viburnum), and *V. sargentii* (Sargent viburnum).<sup>3,4</sup>

**Identification:** Larvae (Fig. 2) hatch in May<sup>1,3,5</sup> and feed until mid-June, then pupate.<sup>1,4,5</sup> Adults emerge in July and feed until leaf drop.<sup>1,5</sup> Adults (Fig. 1) are 4.5 - 6.5 mm long,<sup>1,5</sup> yellowish brown to light brown. Oviposition (egg laying) sites are arranged in straight rows on the undersurface of terminal twigs.<sup>1,4,5</sup> A distinct protective “cap” covers each oviposition site.<sup>1,4,5</sup> Mature larvae are larger than the adults about (10 - 11 mm),<sup>4,5</sup> shiny, white or pale green to yellow/brown, and covered with dark spots and dashes.<sup>1,4</sup>



Fig. 2

UGA 9005045

## VIBURNUM LEAF BEETLE

*Pyrrhalta viburni* Paykull



Fig. 3

UGA 1300004



Fig. 4

UGA 1300014

**Signs and Symptoms:** Larvae feed on the areas between leaf veins, resulting in skeletonized leaves (Fig. 3).<sup>1,4,5</sup> Larval damage is seen from late April through the summer.<sup>1,5</sup> Adults chew irregular circular to elliptical holes in the leaves.<sup>5</sup> Adult damage can be seen from late June until leaf drop in fall.<sup>4,5</sup> Oviposition sites are also visible on terminal twigs (Fig. 4).

**Similar Species:** No similar species are found feeding on viburnum. The related Galerucella (*Neogalerucella*) beetle (Fig. 5), which is used as a biological control for purple



loosestrife (*Lythrum salicaria* L.), looks similar but is slightly smaller and does not attack viburnum shrubs.<sup>2</sup>

Fig. 5 UGA 2158020

# THOUSAND CANKERS DISEASE

[*Pityophthorus juglandis* Blackman]  
[*Geosmithia* sp.]



Fig. 1

UGA 5406088

Fig. 2

UGA 5406094

**Problem:** Thousand Cankers Disease (TCD) (Figs. 1 and 2) is a pest complex that is causing widespread mortality in primarily black walnut (*Juglans nigra* L.) in many western states, and most recently, Tennessee.<sup>1,4,5,7</sup> It is caused by an unnamed fungus of the genus *Geosmithia* that is vectored into the tree by the walnut twig beetle (WTB) (*Pityophthorus juglandis* Blackman); a bark beetle native to North America (Arizona, New Mexico, California, and certain areas of Mexico).<sup>1,2,3</sup> The common name for this disease is derived from the coalescing cankers surrounding multiple beetle entry points on twigs, branches, and main stems.<sup>1,3,7</sup>

**Identification:** Adult WTB are very small, 1½ to 2 mm (~ 1/16 in) long, and are reddish-brown in color (Figs. 3 and 4).<sup>3,7</sup> WTB prefers to colonize branches greater than 1½ cm (~5/8 in) in diameter and will also colonize the main stem.<sup>2,7</sup> Larvae are white, c-shaped and found in the phloem.<sup>3</sup> WTB is the only *Pityophthorus* species associated with walnut, but can be distinguished from other members of the genus by 4 to 6 concentric rows of ridges (asperities) on the upper surface of the pronotum (shield-like cover behind and over the head) (Fig. 4).<sup>3,7</sup> Aside from causing cankers that rarely show external symptoms,<sup>5</sup> *Geosmithia* fungus is inconspicuous and must be cultured on agar to confirm identity.<sup>3</sup>



Figs. 3 and 4

Jim LaBonte

# THOUSAND CANKERS DISEASE

*Pityophthorus juglandis* Blackman

*Geosmithia* sp.



Fig. 5

UGA 5406047

**Signs and Symptoms:** Early symptoms include thinning foliage and yellowing of leaves in the upper crown (Fig. 5).<sup>1,5</sup> As the disease progresses, larger, dead limbs may exhibit dieback and leaf flagging (Fig. 6).<sup>1,5</sup>



Fig. 6

UGA 5406045

Visually surveying for dieback is the best tool to detect TCD.<sup>3</sup> Numerous small circular to oblong cankers form in the phloem under the bark, which eventually kill the cambium (Fig. 1). The bark may not exhibit symptoms, but can crack and become dark and stained above a canker.<sup>1,5</sup> Tiny WTB entrance and exit holes are usually visible on dead

and dying branches (Fig. 7) and galleries, generally 2½ to 5 cm (1 to 2 in) long, are often found within the cankers (Fig. 2).<sup>1,3,7</sup>

**Similar Species:** Most canker producing fungi that

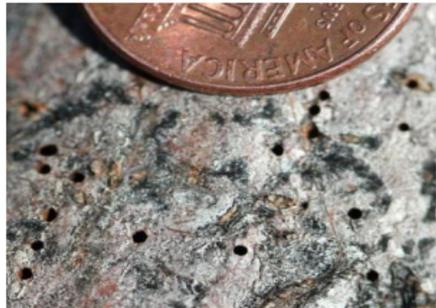


Fig. 7

UGA 5406073

affect walnut trees show external symptoms. TCD cankers rarely exhibit external symptoms.<sup>5</sup> Anthracnose causes rapid leaf drop, while TCD-killed leaves remain attached to branches. Fusarium cankers are visible without removing bark and often begin formation at the base of the tree.<sup>6</sup> Crown dieback and defoliation can also be caused by many abiotic factors such as drought, ice damage, and poor site conditions.<sup>6</sup>

# CHINESE LESPEDEZA

[*Lespedeza cuneata* (Dum. Cours.) G. Don]  
LECU



Fig.1

UGA 5302020

**Problem:** Native to eastern Asia,<sup>1,2,5,7</sup> Chinese lespedeza (Fig.1) forms dense, vigorously spreading stands that displace native plants. Allelopathic compounds inhibit native plant colonization and an extensive taproot enables competitiveness during droughts.<sup>3,6</sup>

**Habit:** Erect,<sup>5,7</sup> shrubby, perennial.<sup>1,3,4,5,6</sup> Shade intolerant.<sup>3</sup>

**Reproduction:** Spreads vegetatively via root system and sexually via seed production;<sup>3,4</sup> Cross and self-pollinates.<sup>4</sup>

**Leaves:** Alternate, trifoliate (Fig. 2).<sup>2,3</sup> Leaflets ½ to 3 cm long ( $\sim 3/16$  to  $1\ 3/16$  in),<sup>3,4,6,7</sup> oblong to linear with a hair-like tip or mucron,<sup>2,4</sup> and base is wedge-shaped or cuneate.<sup>3,5,6</sup> Leaves are green and smooth (glabrous) above, white to gray with dense hairs beneath (pubescent).<sup>1,2,4,5,6,7</sup>

**Stems:** Coarse, stiff;<sup>2,6</sup> upright to ascending,<sup>7</sup> 1 to 2 m (3 to 6 ft);<sup>1,4,7</sup> often gray-green with lines of hairs.<sup>4</sup>

**Flowers:** July to October;<sup>3,4,5,6</sup> two types:<sup>3,6</sup> showier flowers



Fig.2

UGA 0016190

## CHINESE LESPEDEZA

*Lespedeza cuneata* (Dum. Cours.) G. Don



Fig.3

UGA 1120169



Fig. 4

UGA 1237107

emerge from the leaf axils bearing clusters of 1 to 4 creamy white to light yellow pea-like flowers marked with purple or pink (Figs. 3 and 4);<sup>1,2,3,4,5,6,7</sup> The other flower type does not have showy petals and typically do not open.<sup>6</sup>

**Fruits/Seeds:** September to October;<sup>7</sup> flat, ovate to round, and pubescent single-seeded legume pod or loment; 2-5 mm long ( $\sim 1/16$  to  $3/16$ ).<sup>5,6,7</sup> Loments are clustered in terminal axils and clasped by persistent sepals.<sup>4,7</sup>

**Habitat:** Meadows, pastures, forest openings,<sup>4</sup> and disturbed habitats like roadsides and drainage ditches;<sup>3,6</sup> tolerates poor soil conditions.<sup>3,6</sup>

**Similar Species:** Slender lespedeza [*Lespedeza virginica* (L.) Britton] (Fig. 5) grows in tufted clumps, stems are fewer, weaker,<sup>6</sup> and not spreading. It also produces pink to purple flowers in crowded clusters.<sup>2,4</sup> Roundhead lespedeza (*L. capitata* Michx.) produces head-like or capitate clusters (Fig. 6) of white flowers;<sup>4</sup> leaflets are larger.<sup>2,5</sup>



Fig.5

UGA 1120166

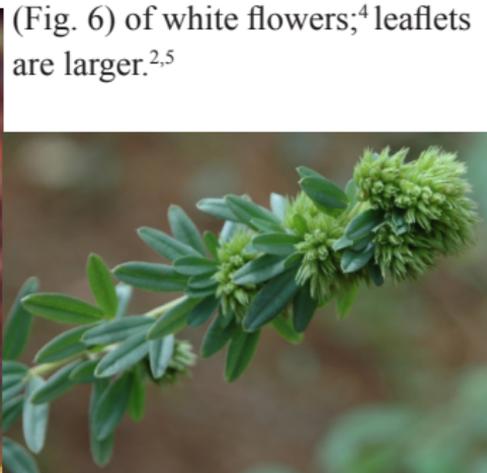


Fig. 6

UGA 2122087

# AMUR PEPPERVINE

[*Ampelopsis brevipedunculata* (Maxim.) Trautv.]

AMBR7



Fig. 1

UGA 5379592

**Problem:** Native to Asia,<sup>2,3</sup> amur peppervine (APV) (Fig. 1) is a fast growing vine that can overtop and weigh-down native shrubs and trees, completely shading them from the sun and making them more susceptible to wind and ice damage.<sup>5</sup>

**Habit:** Perennial, climbing vine.<sup>4</sup>

**Reproduction:** Primarily by seed, vegetatively; seeds are dispersed by birds and water.<sup>5</sup>

**Leaves:** Alternate, simple, variable (Fig. 2); palmately 3 to 5 lobed<sup>3,4</sup> with coarse teeth and a wedge-shaped base;<sup>1,3</sup> ~5 to 10 cm (2 to 4 in) wide. Young twigs, petioles and the undersides of the leaves are hairy.<sup>1,2,3</sup>

**Stems:** Woody, tendril-bearing;<sup>3</sup> can grow ~3 to 8 m (10 to 25 ft) or more.<sup>1</sup> Tendrils grow opposite the leaves on the stem.<sup>4</sup> The pith is white.<sup>2,4</sup>

**Flowers:** Small, inconspicuous, and greenish-white<sup>1</sup> (Fig. 3); Grow opposite leaves in cymose (flat or round-topped) clusters.<sup>2,3</sup> Appear May through August.<sup>4</sup>

**Fruits/Seeds:** Speckled, 6 to 8 mm (~0.25 in)<sup>1</sup> hard berries, ripening from September to October. Fruits are borne in

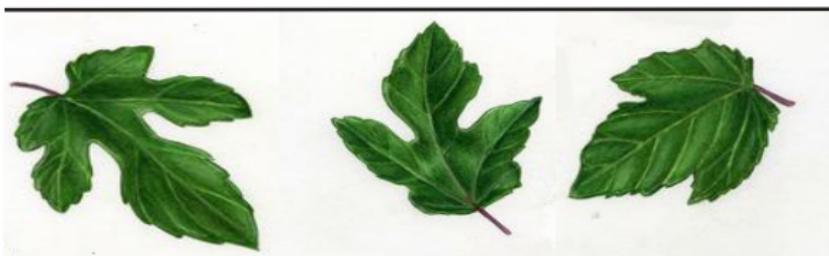


Fig. 2

[www.discoverlife.org](http://www.discoverlife.org)

## AMUR PEPPERVINE

*Ampelopsis brevipedunculata* (Maxim.) Trautv.



Fig. 3

UGA 5270018

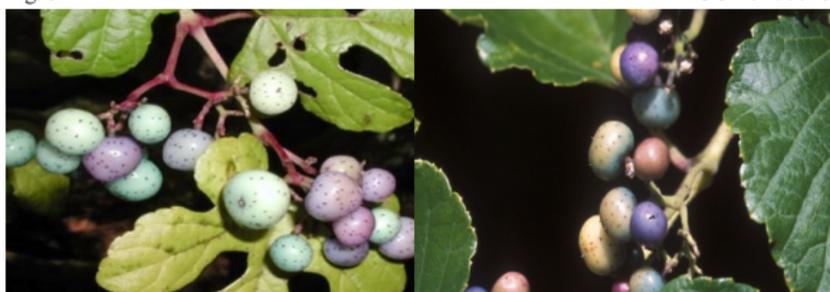


Fig. 4

UGA 5270016 Fig. 5

UGA 1539038

clusters and vary in color<sup>2</sup> from yellow to lilac and mature to blue<sup>1,2</sup> (Figs. 4 and 5).

**Habitat:** It grows well in most soils, especially in pond margins, streambanks, and waste places where there is full sunlight to partial shade. Does not tolerate permanently wet soils.<sup>1,5</sup>

**Similar Species:** Native grape species (*Vitis* L.) have paniced fruit (Fig. 6), a brown stem pith, and shredding or peeling bark<sup>2,4,5</sup> (Fig. 7). APV has a white stem pith and its bark does not peel.<sup>2,5</sup> In addition, APV bark has lenticels while grape does not.<sup>2,5</sup>



Fig. 6

UGA 1556207 Fig. 7

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# JAPANESE HOP

[*Humulus japonicus* Siebold & Zucc. ]

## HUJA



Fig. 1

UGA 5272028

**Problem:** Native to eastern Asia,<sup>3,6,7</sup> Japanese hop (Fig. 1) was introduced to North America as an ornamental in the mid-to-late 1800s.<sup>4,5</sup> It is a rapid-growing vine that out-competes native plants by overtopping and shading them.<sup>4,5</sup>

**Habit:** Annual, herbaceous, climbing or trailing vine.<sup>1,3,7</sup>

**Reproduction:** Primarily by seed; dispersed by wind and water;<sup>5</sup> dioecious.<sup>2,3,6</sup>

**Leaves:** Opposite, simple;<sup>3</sup> palmately lobed: 5 to 9 lobes for principle leaves, 5 to 12 cm (2 to 4¾ in), and 3 to 5 lobes for uppermost leaves.<sup>4,5</sup> Serrate margin and rough surface;<sup>2,3,7</sup> underside of leaf is pubescent<sup>7</sup> and leaf sinuses are v-shaped or form an acute angle (Fig. 2).<sup>5,6</sup>

**Stems:** Covered with sharp downward-curved hairs; triangular-shaped bracts at base of leaf petioles (Fig. 3).<sup>1,4,7</sup>



Fig. 2

UGA 1334130



Fig. 3

UGA 1334132

## JAPANESE HOP

*Humulus japonicus* Siebold & Zucc.



Fig. 4

UGA 5272027

**Flowers:** Mid-summer to October;<sup>6</sup> greenish; 5-petaled. Male flowers bloom along upright stems and female flowers hang down in cone-shaped clusters.<sup>1,4,5,7</sup> Bracts around female flowers are hairy and pointed (Fig 4) and weakly or not at all glandular.<sup>1,6</sup>

**Fruits/Seeds:** Achene enclosed in persistent calyx (set of sepals and covered with bracts);<sup>3,6</sup> exposed from the bract at maturity in the fall.<sup>7</sup>

**Habitat:** Meadows, roadsides, waste places,<sup>1,4,5,6</sup> and floodplains.<sup>5,7</sup>

**Similar Species:** Common hop (*Humulus lupulinus* L.) leaves have U-shaped sinuses (Fig. 5) versus v-shaped sinuses of Japanese hop.<sup>6</sup> In addition, inflorescence bracts are usually strongly glandular on common hop.<sup>3,6</sup> Bur cucumber (*Sicyos angulatus* L.) (Fig. 6) is also similar, but leaves are alternate and shallowly 3 to 5-lobed.<sup>3,6</sup> It climbs via tendrils and fruits lack the persistent calyx and bracts.



Fig. 5

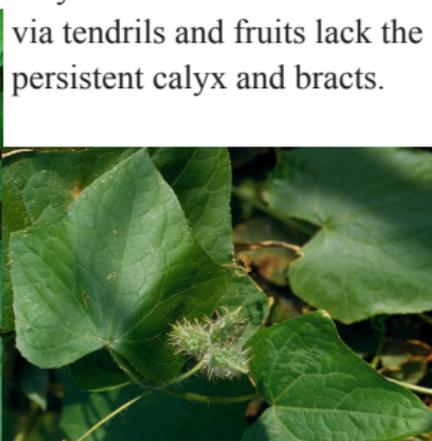


Fig. 6

UGA 5309047

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# JETBEAD

[*Rhodotypos scandens* (Thunb.) Makino ]

RHSC3



Fig. 1

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**Problem:** Native to eastern Asia,<sup>1,2,5</sup> jetbead (Fig. 1) was introduced to the United States in 1866.<sup>1</sup> This species can form dense stands in the understory that can inhibit the growth of native plants.<sup>4</sup>

**Habit:** Loosely branched, deciduous shrub with ascending and somewhat arching branches;<sup>1</sup> to 2 m (6 ft) tall<sup>1,5</sup> and ~3 m (9 ft) wide.<sup>1</sup>

**Reproduction:** Sexually by seed and vegetatively;<sup>1</sup> seeds are dispersed by birds.<sup>4</sup>

**Leaves:** Opposite, simple,<sup>3</sup> ovate, acuminate or long pointed tip, ~6.5 to 10 cm (2½ to 4 in) long, doubly serrate margin;<sup>1,4</sup> bright green and glabrous above, lighter green and silky beneath;<sup>1</sup>



Fig. 2

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short petioles<sup>1</sup> (Fig. 2).

**Stems:** Young: green and glabrous and shiny;<sup>1</sup> older stems are gray streaked with orange to reddish-brown lenticels.<sup>1</sup>

**Flowers:** April to early June;<sup>1,5</sup> 4-petaled white flowers from ~2 to 5 cm (~¾ to 2 in) diameter;<sup>1,5</sup> (Fig. 3) born singly at end of short twigs.<sup>1</sup>

## JETBEAD

*Rhodotypos scandens* (Thunb.) Makino



Fig. 3

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**Fruits/Seeds:** Clusters of 3 to 4 red turning shiny black, 1-seeded, berry-like drupelets (Fig. 4).<sup>1,5</sup> Fruits ripen in October and persist through the winter.<sup>1</sup>

**Habitat:** Roadsides, disturbed woods, and cultivated landscapes.<sup>5</sup> Hardy; grows in a wide range of soil and light conditions.<sup>1,4</sup>

**Similar Species:** When sapling-size, the leaves of some species in the birch family, Betulaceae, may resemble jetbead (Figs. 5 and 6), however, branching is alternate,



Fig. 4

Dalgial CCBySA-3.0

generally single-stemmed. Native shrubs in the *Viburnum* genus may also resemble jetbead. Branching is opposite, but the form is different and the fruits differ in color and number of fruits per cluster (Figs. 7 and 8).

Fig. 5

Fig. 6

Fig. 7

Fig. 8



UGA 0008300

UGA 0008302

J. Shreiner

UGA 5147072

# LINDEN ARROWWOOD

[*Viburnum dilatatum* Thunb.]

## VIDI80



Fig. 1

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**Problem:** Native to Asia,<sup>1,2,5</sup> linden arrowwood (LA) was introduced to the United States before 1845.<sup>1</sup> This species can dominate the understory,<sup>5</sup> growing into thickets that can exclude native plants (Fig. 1).<sup>3</sup>

**Habit:** Multi-stemmed, deciduous shrub,<sup>6</sup> to 3 m (~10 ft) tall,<sup>5,6</sup> ~2 to 3 m (6 to 10 ft) wide.<sup>6</sup>

**Reproduction:** Sexually by seed and vegetatively by root suckers (Fig. 1);<sup>1</sup> seeds are dispersed by birds.<sup>3</sup>

**Leaves:** Opposite, simple, suborbicular to ovate, 6 to 12 cm (~2 to 5 in) long, toothed,<sup>1,5,6</sup> pubescent on both sides<sup>1,2,5</sup> (Fig. 2); tend to persist later in fall.<sup>6</sup>

**Stems:** Gray<sup>1</sup> to brown with prominent orange lenticels, branchlets pubescent.<sup>5,6</sup>

**Flowers:** May to early June,<sup>1,5</sup> Small creamy white, in flat-topped 8 to 12 cm (~3 to 5 in) clusters or cymes<sup>1,2,5,6</sup> (Fig. 3).

**Fruits/Seeds:** Ripen September to October,<sup>1,5,6</sup> bright red



Fig. 2

UCONN Plants Database

## LINDEN ARROWWOOD

*Viburnum dilatatum* Thunb.



Fig. 3 UCONN Plants Database

berry-like drupe<sup>1,2,5,6</sup> (Fig. 4); fruit clusters persist into December<sup>1</sup> and tend to resemble shriveled cranberries.

**Habitat:** Colonizes wetlands, riparian areas, open woods and forest edges.<sup>3</sup>

**Similar Species:** *Viburnum opulus* L. var. *americanum* Aiton (American cranberry bush) (ACB) also has bright red clustered fruits, but the leaves are palmately lobed and the inflorescences have larger marginal flowers<sup>5</sup> (Fig. 5). *Viburnum dentatum* L. (southern arrow-wood) (SA) and *Viburnum recognitum* Fernald (northern ar-

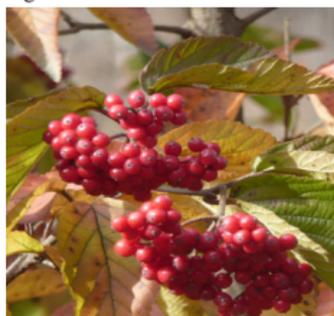


Fig. 4 Jeffrey Shreiner

row-wood) (NA) both have very coarsely toothed leaf margins, the fruits are blue to black (Fig. 6), and the leaves are glabrous on SA and only pubescent beneath on NA.<sup>5</sup>



Fig. 5

UGA 5399748



Fig. 6

UGA 5147072

# JAPANESE ARALIA

## [*Aralia elata* (Miq.) Seem.]

### AREL8



Fig. 1

UGA 5391891

**Problem:** Native to Asia,<sup>1,2,3</sup> Japanese aralia (JA) was introduced to the United States as an ornamental<sup>3</sup> in 1830.<sup>1</sup> This rapidly growing<sup>4</sup> species is believed to be displacing the native devil's walkingstick (DWS) (*Aralia spinosa* L.) in the forest understory.<sup>3</sup> It is also possible that the dense foliage

suppresses growth of native plant species.<sup>4</sup>

**Habit:** Deciduous woody shrub or tree to 10 m (~33 ft) (Fig. 1).<sup>2</sup>

**Reproduction:** Root suckers from base;<sup>4,5</sup> much less often by seed.<sup>5</sup>

**Leaves:** Alternate, bi- to tri-pinnately compound leaves<sup>2</sup> (Fig. 2), ~6 to 12 dm (2 to 4 ft) long;<sup>4</sup> pubescent beneath.<sup>1,2,5</sup> Veins of the leaflets run into the teeth.<sup>1,2,3</sup>

**Stems:** Stout, spiny stems;<sup>1,2</sup> prominent leaf scars<sup>4</sup> (Fig. 3).

**Flowers:** Late July through August;<sup>2,4</sup> small and white; inflorescence 3 to 6 dm (~1 to 2 ft) with central axis short or lacking<sup>2,3</sup> ("often wider than tall, with base usually surrounded by and even overtopped with foliage")<sup>3</sup> (Fig. 4).

**Fruits/Seeds:** August to September;<sup>2,3</sup> purple to black<sup>3,4,5</sup> berry-like drupe.<sup>2</sup>

**Habitat:** Wood edges, open areas, and thickets, especially



Fig. 2

UGA 5391892



Fig. 3

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## JAPANESE ARALIA

*Aralia elata* (Miq.) Seem.



Fig. 4

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around urban areas;<sup>3</sup> Prefers moist, well-drained soils, but can grow in any soil type; sun to partial shade.<sup>4</sup>

**Similar Species:** JA is nearly identical to DWS and can be difficult to distinguish from one another. Both have spines on the stems, white flowers, purple to black fruits and can grow to similar heights. Veins of DWS leaflets do not run into the teeth (Fig. 5), whereas JA leaflet veins do run into the teeth<sup>1,2,3</sup> (Fig. 6). The inflorescence of DWS has a distinctive central axis<sup>2</sup> (“typically taller than wide, base usually elevated above foliage”)<sup>3</sup> (Fig. 7). Although vari-



Fig. 5

UGA 1342093



Fig. 6

© 2005 Louis-M. Landry



Fig. 7

UGA 1391360

able, the leaflets of JA are usually sessile, while DWS has distinct petiolules.<sup>3</sup> Leaves of JA are pubescent beneath, while DWS are nearly glabrous or smooth beneath.<sup>1,2,4</sup>

# AMUR CORKTREE

[*Phellodendron amurense* Rupr.]

## PHAM2



Fig. 1

© 2004 Nick Kurzenko

**Problem:** Native to eastern Asia,<sup>1,5</sup> Amur cork-tree (AC) was introduced to the United States in 1856.<sup>1</sup> It outcompetes native tree and shrub species in disturbed forest habitats.<sup>3</sup>

**Habit:** Deciduous, broad spreading tree; 15 m (~49 ft) tall,<sup>4</sup> to 30 m (98 ft)<sup>5</sup> (Fig. 1).

**Reproduction:** Seed; dispersed by birds and other animals;<sup>3</sup> germinate like beans without any treatment.<sup>1</sup>

**Leaves:** Opposite, pinnately compound,<sup>2</sup> 5 to 13 leaflets<sup>1,4</sup> (Fig. 2), darker green above and glabrous to pubescent below,<sup>1,4</sup> turning yellow in the fall,<sup>1,4</sup> strong odor when crushed;<sup>3</sup> Axillary buds enclosed by the base of the rachis.<sup>1,4</sup>



Fig. 2

UCONN Plants Database

**Stems:** Stout, orange-yellow to yellow-gray, changing to brown;<sup>1</sup> lenticels prominent when young, inner bark bright yellow<sup>1,4</sup> (Fig. 3). Bark on older trees is gray, ridged, and deeply furrowed<sup>1,4</sup> (Fig. 4).

**Flowers:** Late May<sup>1</sup> to early June;<sup>1,4</sup> dioecious (male and female flowers occur on different trees), yellow green,<sup>1,4</sup> borne in ~5 to 9 cm (2 to 3 ½ in) long panicles<sup>1</sup> [Fig. 5 (female flowers) and Fig. 6 (male flowers)].

**Fruits/Seeds:** Ripening September to October and persisting into winter;<sup>1,4,5</sup> green turning to black, 8 to 12 mm (~⅛ to ½ in)<sup>4</sup> diameter, five-seeded drupe;<sup>1,2,5</sup> strong odor when bruised or



Fig. 3 (inset)

Fig. 4

Pat Breen

UGA 2188028

# AMUR CORKTREE

*Phellodendron amurense* Rupr.



Fig. 5 UCONN Plants database



Fig. 6

Pat Breen

crushed.  
Borne only on female trees<sup>1,4</sup>  
(Fig. 7).

**Habitat:**  
Disturbed woodlands and road-



Fig. 7

UGA 1367019

sides;<sup>4</sup> prefers full sun and rich soils, but tolerates shade,<sup>5</sup> drought and flooding.<sup>3</sup>

**Similar Species:** At first glance, the native ash species (*Fraxinus* L.) are similar in appearance. However, although both species have opposite, pinnately compound leaves, ash buds are visible and not hidden by the leaf rachis<sup>2,4</sup> (Fig 8). Ash trees also produce samaras (Fig. 9), not berry-like drupes.<sup>2,4</sup> The native hackberry (*Celtis occidentalis* L.) has similar mature bark (Fig. 10), but the branching is alternate, leaves are simple (Fig. 11), and fruit are borne in small clusters with each having a stem or pedicel.<sup>2,4</sup>



Fig. 8

UGA 5032094



Fig. 9

UGA 5349064



Fig. 10

UGA 5034019



Fig. 11

UGA 0008342

# DIDYMO

[*Didymosphenia geminata* (Lyngb.) M. Schmidt]



Fig. 1

© Environment Canada

**Problem:** Didymo or rocksnot is a single-celled freshwater alga belonging to the division Bacillariophyta (diatoms).<sup>1,4</sup> Although present in the western United States for over 100 years,<sup>3</sup> it is expanding its geographical range in North America and Europe<sup>2</sup> and is invasive in New Zealand.<sup>1,4</sup> Didymo has the potential to cause serious ecological and economic impacts.<sup>2,3,4</sup> During nuisance blooms, didymo cells can create copious amounts of stalk material that form thick mats on the bottom of rivers and streams.<sup>4</sup> These mats, which can be over 20 cm (~8 in) thick, are capable of completely covering the substrate and streambed, smothering aquatic plants, and altering macroinvertebrate community composition<sup>2</sup> (Fig. 1).

**Identification:** As the diatom cells attach to the substrate and begin to produce stalks, colonies appear as small, circular clumps (Fig. 2). As the colonies grow (Fig. 3), they merge together and may cover the substrate completely.



Fig. 2

© Biosecurity New Zealand



Fig 3.

© Biosecurity New Zealand

## DIDYMO

*Didymosphenia geminata* (Lyngb.) M. Schmidt



Fig. 4

Tim Daley Fig. 5

© Environmental Canada

As colonies coalesce and stalk production increases, the clumps become thicker. The colonies are frequently 1-2 cm ( $\sim\frac{3}{8}$  to  $\frac{3}{4}$  in) in thickness, but may be greater.<sup>5</sup> The coverage on the streambed may be patchy, or the substrate may be completely covered (Fig. 1). Under periods of low flow or with favorable growth conditions, colonies have the opportunity to form blooms.<sup>5</sup> The cells produce excessive amounts of stalk many times the length of the microscopic cells. As the stalks lengthen, they form ropy strands that can be brown, tan or white in color (Figs. 4 and 5). Some reports describe the strands as tissue, fiberglass, toilet paper, or sheepskins.<sup>5</sup> Although the cells may die, the stalks persist on the stream substrate or stranded above the stream wetted zone. The stalks may persist for 2 months, or more.<sup>5</sup>

**Similar Species:** In the field, didymo can be easily confused with other stalk-forming diatom species. However, didymo is distinctive to the touch. When didymo stalks are pulled apart, there is some resistance and the stalks feel like wet cotton balls. Other diatom species have no such resistance, and they are slimy and slippery.<sup>5</sup>

# WATER CHESTNUT

[*Trapa natans* L.]

TRNA



Fig. 1

UGA 5392661

**Problem:** Native to Eurasia,<sup>1,2,6</sup> water chestnut (Fig. 1) is an aquatic weed that can dominate ponds, lakes, canals and slow moving rivers and streams.<sup>1,4,5</sup> Plants form dense mats that shade-out and displace native vegetation, restrict water movement and limit navigation and recreation.<sup>4,5</sup>

**Habit:** Rooted, freshwater aquatic,<sup>6</sup> annual herb;<sup>1,5</sup> possibly behaves as a perennial in parts of North America.<sup>3</sup>

**Reproduction:** Seed<sup>4,5</sup> and vegetatively.<sup>3</sup> Seeds sink to the hydrosol where they germinate the following season<sup>3,5</sup> or can be dispersed downstream by riding on detached, buoyant floating ramets (clones).<sup>3</sup> Ramets develop along the submerged stem and at the top of the stem and can break off and establish themselves downstream.<sup>3</sup>

**Leaves:** Two types (Fig. 2): submerged leaves opposite to sub-opposite, highly dissected, feathery in appearance;<sup>6</sup>

aerial leaves fan or diamond-shaped, glossy upper surface, hairy lower surface,<sup>4</sup> toothed margins, clustered at water surface, and each attached to stem via a swollen petiole that acts as a float.<sup>1,2,4,6</sup>

**Stems:** Submerged, cord-like (Fig. 2), to 4.8 m (16 ft.).<sup>3</sup>

**Flowers:** Midsummer to frost;<sup>4</sup> inconspicuous,<sup>5</sup>



Fig. 2

UGA 5309016

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## WATER CHESTNUT

*Trapa natans* L.



Fig. 3

UGA 5274093



Fig. 4

UGA 5274098

single, white, axillary, 4 petals (Fig. 3).<sup>2,4,6</sup>

**Fruits/seeds:** Extremely sharp<sup>4</sup> nut-like two-seeded drupe with 2 to 4 sharp spines or horns (Figs. 2, 4 and 5);<sup>1,3,4</sup> 2½ to 4 cm (~1 to 1<sup>9</sup>/<sub>16</sub> in) wide.<sup>4,6</sup> Caution: seeds are capable of penetrating shoe leather.<sup>4</sup>

**Habitat:** Lakes, ponds, canals, and slow-moving streams and rivers.<sup>1,4,5</sup>

**Similar Species:** There are no other freshwater aquatic plants that can be confused with water chestnut.

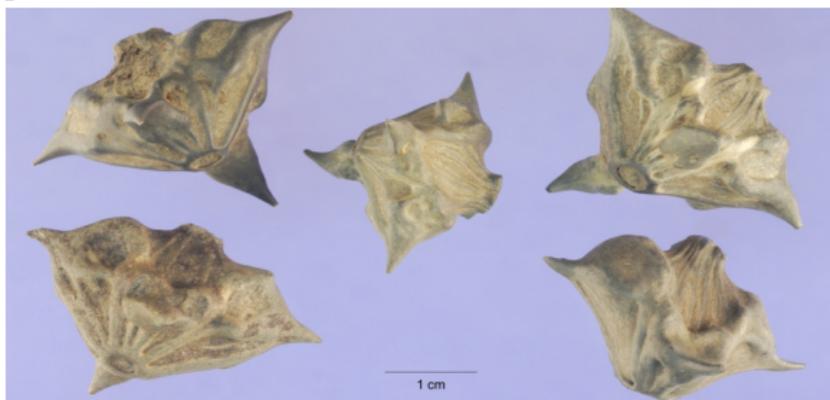


Fig. 5

UGA 5309017

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Additional comments and expertise provided by Wayne Millington, Northeast Regional Integrated Pest Management Coordinator, National Park Service.

### **Photograph Information:**

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## **Supplement 1, May 2011**

## Thousand Cankers Disease

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Figures 5, 6 and 7 (photographer: Whitney Cranshaw, Colorado State University).

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Figures 3 and 4 (photographer: Jim LaBonte, Oregon Department of Agriculture).

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## **Supplement 1, May 2011**

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### **Photograph Information:**

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Figures 2 and 3 (photographer: James H. Miller, USDA Forest Service).

Figure 4 (photographer: Dan Tenaglia, Missouriplants.com).

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## **Supplement 1, May 2011**

## *Ampelopsis brevipedunculata*

### (Amur peppervine)

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Figures 1 and 4 (photographer: Leslie J. Mehrhoff, University of Connecticut).

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Figure 9 (photographer: Keith Kanoti, Maine Forest Service).

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## **Supplement 1, May 2011**

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### **Photograph Information:**

Figure 1 (photographer: John M. Randall, The Nature Conservancy).

Figure 2 (USDA PLANTS Database, USDA NRCS PLANTS Database).

Figures 3 and 4 (photographer: Leslie J. Mehrhoff, University of Connecticut).

Figure 5 (photographer: Steve Hurst, USDA NRCS PLANTS Database).

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## **Supplement 1, May 2011**