

# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms



Photo credits: Anette Phibbs and Susan Lueloff  
DATCP Plant Industry Laboratory  
unless otherwise noted.

We hope this gallery of symptoms will be helpful to nursery professionals and plant enthusiasts in recognizing annuals and perennials that may be infected with plant viruses. Viruses can cause plant diseases that affect the quality and viability of plants. The plant materials shown in these photographs were collected from 2007 to 2014, as part of a collaborative survey by DATCP's Plant Industry Laboratory, the University of Minnesota, Plant Disease Clinic, Michigan, Minnesota and Ohio Departments of Agriculture. The material is sorted alphabetically by host genus. High resolution images are also available on [bugwood.com](http://www.ipmimages.org/) under <http://www.ipmimages.org/> There are of course many more plant virus diseases than are depicted here.

**DISCLAIMER:** Final diagnosis should include appropriate test methods and should not be based on visual symptoms alone.

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms



'Azure' Monkshood (*Aconitum fischeri*) infected with aconitum latent virus (AcLV), cucumber mosaic virus (CMV), and a potexvirus.

Detection methods:

Electron microscopy, University of Minnesota, Plant Disease Clinic.

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

'Azure' Monkshood (*Aconitum fischeri*) infected with cucumber mosaic virus (CMV).



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## Gallery of Plant Virus Symptoms

Monkshood (*Aconitum*) infected with filamentous virus particles.



Detection method: Electron microscopy, University of Minnesota, Plant Disease Clinic.

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## Gallery of Plant Virus Symptoms

Black Cohosh, (*Actaea racemosa*) infected with an undetermined potyvirus.



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## Gallery of Plant Virus Symptoms

Mexican giant hyssop 'Acapulco Orange' (*Agastache*)  
infected with impatiens necrotic spot virus (INSV).



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## Gallery of Plant Virus Symptoms

Bugleweed 'Gaiety' (*Ajuga*) infected with cucumber mosaic virus (CMV).



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## Gallery of Plant Virus Symptoms

Hollyhock 'Chaters Double Mix' (*Alcea rosea*) infected with TRV.



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## Gallery of Plant Virus Symptoms

Peruvian lily (*Alstroemeria*) infected with tomato spotted wilt virus (TSWV).



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## Gallery of Plant Virus Symptoms

Grape-leaf anemone 'Robustissima' (*Anemone tomentosa*)  
infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Grape-leaf anemone 'Robustissima' (*Anemone tomentosa*) infected with TRV.



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## Gallery of Plant Virus Symptoms



Anemone 'Serenade' infected with TRV and root knot nematode.

Female root knot nematode  
(*Meloidogyne hapla*)



Root knot

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Horseradish (*Armoracia rusticana*)  
infected with tobacco rattle virus (TRV).



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## Gallery of Plant Virus Symptoms

*Astilbe arendsii* 'Fanal' infected with cucumber mosaic virus (CMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

*Astilbe arendsii* 'Fanal' infected with CMV and TRV.



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Astilbe infected with tobacco rattle virus (TRV).



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## Gallery of Plant Virus Symptoms

*Begonia x hiemalis* 'Cindy Fringed' infected with impatiens necrotic spot virus (INSV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

*Begonia x hiemalis* 'Dark Britt' infected with impatiens necrotic spot virus (INSV).



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## Gallery of Plant Virus Symptoms

Tuberous begonia  
(*Begonia x hiemalis*)  
infected with CMV.  
'Non-Stop Rose Petticoat' and  
'Go-Go Rose Bicolor'  
on the left,  
healthy 'Non-Stop Apricot'  
on the right.



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**Gallery of Plant Virus Symptoms**

Tuberous begonia infected with CMV.



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## Gallery of Plant Virus Symptoms

Blackberry lily (*Belamcanda chinensis*)  
infected with tomato spotted wilt virus (TSWV).



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**Gallery of Plant Virus Symptoms**

Bergenia infected with tobacco rattle virus (TRV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms



Bellflower (*Campanula*)  
infected with  
cucumber mosaic virus (CMV).

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**Gallery of Plant Virus Symptoms**

Canna 'Crimson Beauty' infected with canna yellow streak potyvirus (CaYSV).



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**Gallery of Plant Virus Symptoms**

Canna 'Banana Punch' infected with canna yellow streak potyvirus (CaYSV).



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## Gallery of Plant Virus Symptoms

Hackberry (*Celtis occidentalis*) with “hackberry island chlorosis”, believed to be associated with virus, and seed transmitted.



Detection: University of Minnesota, Plant Disease Clinic.

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## Gallery of Plant Virus Symptoms

Clematis 'Dancing Queen' (left) and 'Dancing Dorian' (right) infected with clematis chlorotic mottle tomosvirus (CICMoV).



Detection method: Electron microscopy, RT-PCR University of Minnesota, Plant Disease Clinic.

# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Clematis 'Dancing Smile' (left) and 'Natascha' (right) infected with clematis chlorotic mottle tombusvirus (CICMoV).



University MN,  
Plant Disease Clinic.

*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Clematis 'Multi Blue' infected with clematis chlorotic mottle virus (ClCMoV).



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## Gallery of Plant Virus Symptoms



Dahlia infected with dahlia common mosaic virus (DCMV).



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## Gallery of Plant Virus Symptoms

Bleeding heart (*Dicentra spectabilis*, new name: *Lamprocapnos spectabilis*)  
infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Bleeding heart (*Dicentra spectabilis*) infected with TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Bleeding heart (*Dicentra spectabilis*) infected with TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

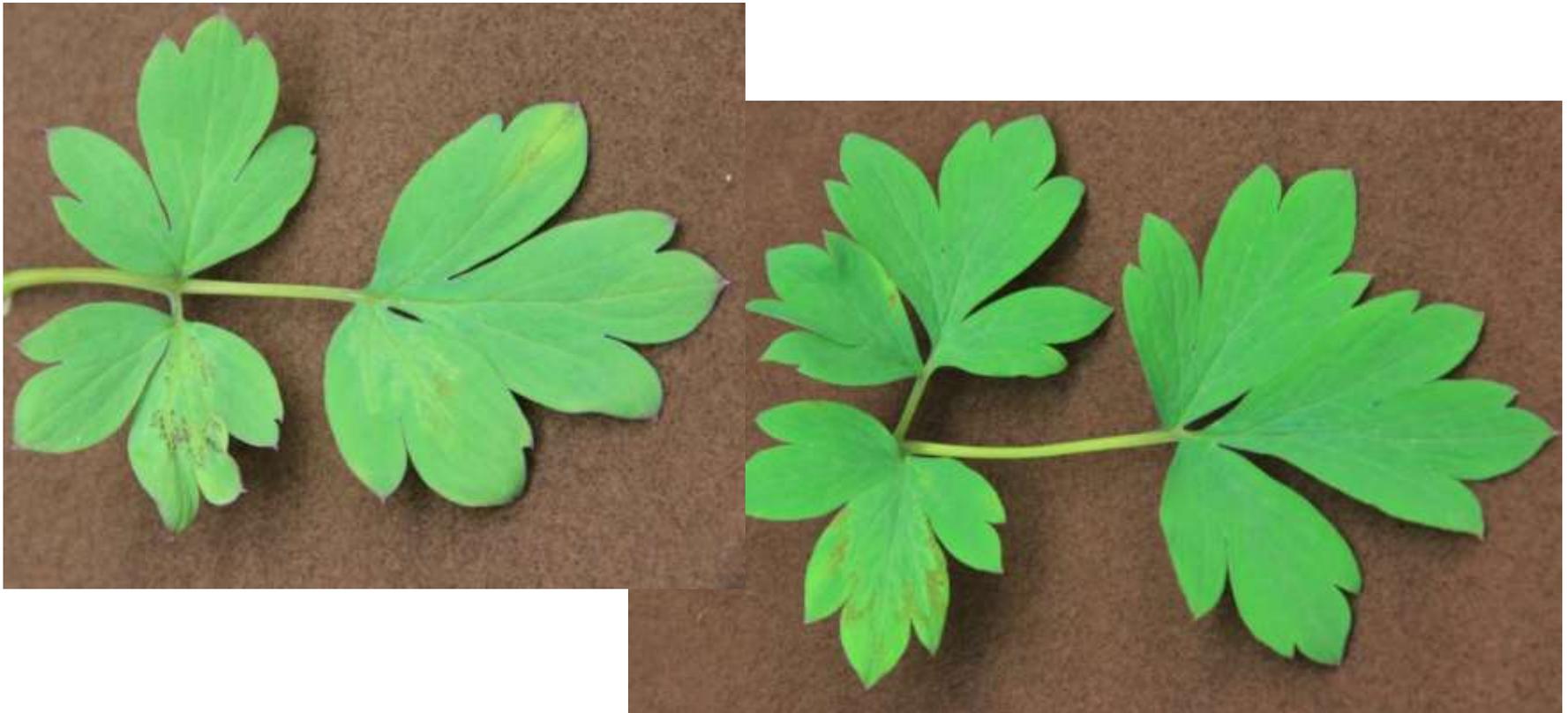
Bleeding heart (*Dicentra spectabilis*) infected with TRV.



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## Gallery of Plant Virus Symptoms

Bleeding heart 'Pink' (*Dicentra*) infected with CMV and TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Bleeding heart (*Dicentra*) infected with CMV and TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Larkspur (*Delphinium elatum*) infected with TRV.

1. 'Lilac Pink',
2. 'Magic Fountain' dark blue/white bee,
3. 'Magic Fountain' pure white.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Larkspur (*Delphinium elatum*) infected with TRV.



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Larkspur (*Delphinium*) 'Magic Fountain' infected with tobacco mosaic virus (TMV).



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## Gallery of Plant Virus Symptoms

Purple Coneflower (*Echinacea purpurea*) 'Magnus' infected with CMV.



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## Gallery of Plant Virus Symptoms

Barrenwort `Rubrum' (*Epimedium alpinum*) infected with TRV.



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**Gallery of Plant Virus Symptoms**

Barrenwort 'Creeping yellow' (*Epimedium*) infected with TRV.



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## Gallery of Plant Virus Symptoms

Barrenwort (*Epimedium pubigerum*) infected with TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Barrenwort (*Epimedium x rubrum*) infected with TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Barrenwort 'Sulphureum' (*Epimedium x versicolor*) infected with TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Barrenwort infected with tobacco rattle virus (TRV).



- 1) *Epimedium pubigerum* 'Orange Queen'
- 2) *Epimedium pinnata elegans*
- 3) *Epimedium youngianum* 'Niveum'

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## Gallery of Plant Virus Symptoms

'Black Jack' fig (*Ficus carica*) infected with fig mosaic virus (FMV).



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**Gallery of Plant Virus Symptoms**



Gladiolus infected with bean yellow mosaic virus (BYMV) on left and cucumber mosaic virus (CMV) on right.

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**Gallery of Plant Virus Symptoms**

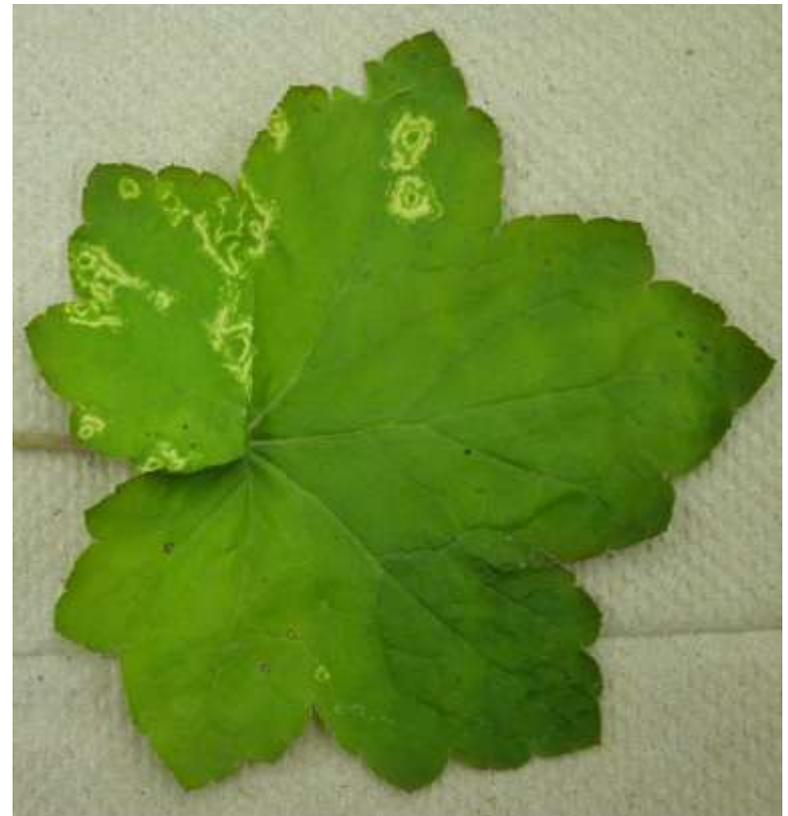
Sneezeweed (*Helenium*) 'Chelsey' infected with CMV.



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## Gallery of Plant Virus Symptoms

Coral bells (*Heuchera*) infected with tobacco rattle virus (TRV).



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**Gallery of Plant Virus Symptoms**

Hosta or plantain lily 'Albo-Marginata' infected with arabis mosaic virus (ArMV).



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**Gallery of Plant Virus Symptoms**

Hosta 'Albo-Marginata' infected with HVX.



Hosta 'Daybreak' infected with HVX.



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms



Hosta 'Blue Angel'  
infected with TRV.



Hosta 'Honeybells'  
infected with TRV.

# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms



Hosta  
'Magic Fire'



Hosta funkia  
'Regal Splendor'



Hosta funkia 'Krossa Regal'

Hosta varieties  
infected with  
tobacco rattle virus  
(TRV).

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**Gallery of Plant Virus Symptoms**

Hosta 'Golden Tiara' infected with hosta virus X (HVX).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Hosta 'Paul's Glory' infected with hosta virus X (HVX) and arabis mosaic virus (ArMV).



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Hosta varieties infected with tobacco rattle virus (TRV).



Hosta 'So Sweet'  
ringspot pattern symptom.



Hosta 'Christmas Tree'  
color bleeding symptom.

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**Gallery of Plant Virus Symptoms**

Hosta 'Sum & Substance' infected with hosta virus X (HVX).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Hosta 'Undulata' infected with hosta virus X (HVX) and tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Wax plant (*Hoya carnosa*)  
infected with  
impatiens necrotic spot virus  
(INSV).



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**Gallery of Plant Virus Symptoms**

Bearded iris 'Avalon Sunset' infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Dwarf German iris (*Iris*) infected with iris severe mosaic potyvirus (ISMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Leopard plant (*Ligularia*) infected with tomato spotted wilt virus (TSWV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Oriental lily 'Angelique' (*Lilium oriental*) infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Oriental lily 'Casablanca' (*Lilium*) infected with lily symptomless virus (LYLSV).



Detection Method: ELISA, Ohio Department of Agriculture.

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## Gallery of Plant Virus Symptoms

Lily 'Scarlet Delight' (*Lilium*) infected with lily mottle potyvirus (LMoV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Cardinalflower (*Lobelia*) infected with cucumber mosaic virus (CMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Cardinalflower (*Lobelia*) infected with spherical virus particles.



Detection method: Electron microscopy, University of Minnesota, Plant Disease Clinic.

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Cardinalflower 'Ruby Slippers' (*Lobelia*) infected with cucumber mosaic (CMV), tobacco rattle (TRV) and turnip mosaic potyvirus (TuMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Lupine 'Minarette' (*Lupinus*) infected with tomato spotted wilt virus (TSWV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Maltese cross 'Vesuvius' (*Lychnis x arkwrightii*)  
infected with impatiens necrotic spot virus (INSV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Creeping Jenny (*Lysimachia*) infected with impatiens necrotic spot virus (INSV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Mandevilla sp. 'Fury Fancy Pink' and 'Teepee Mini Pink' infected with cucumber mosaic virus (CMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Mandevilla 'Red Riding Hood' (*Mandevilla sanderi*)  
infected with cucumber mosaic virus (CMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

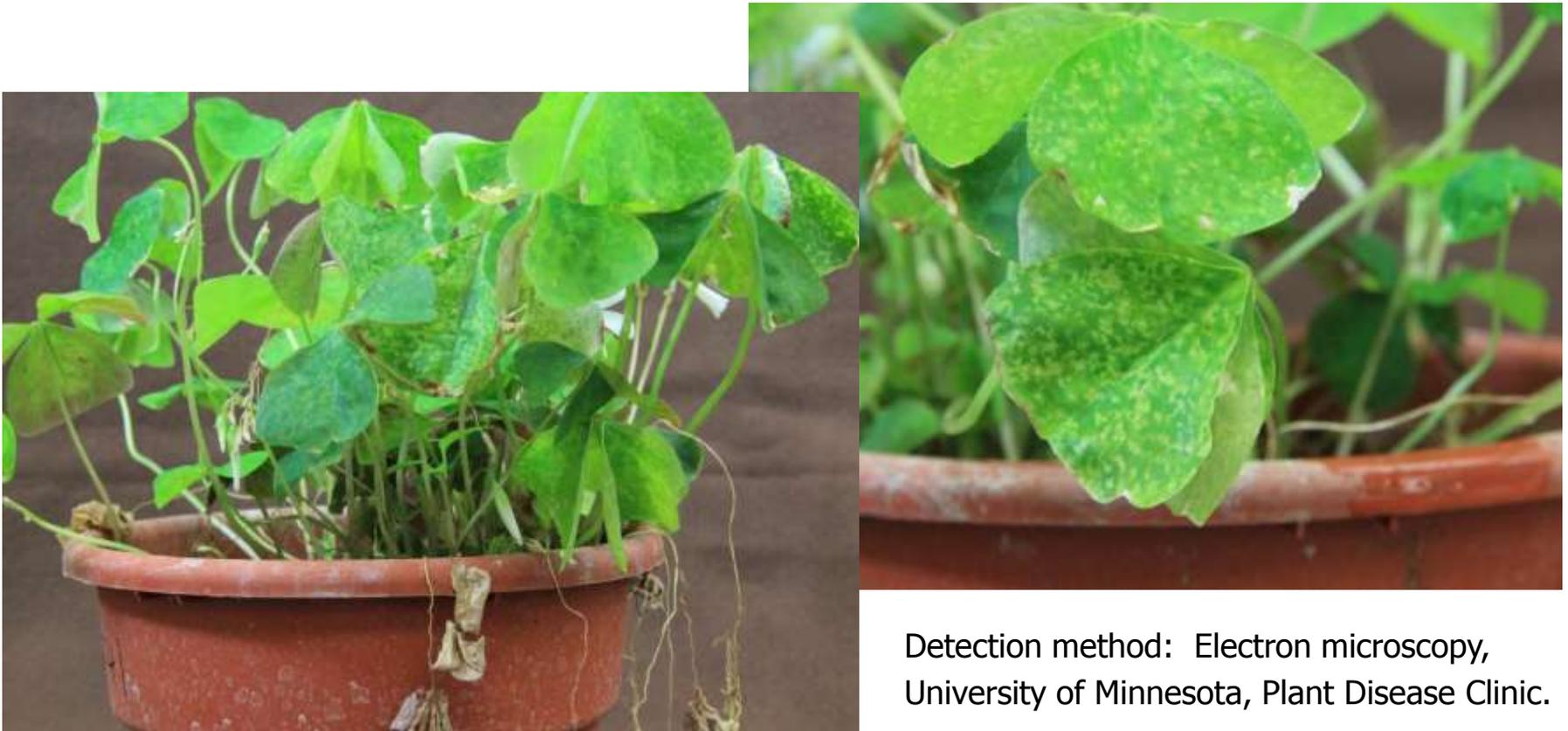
Virginia bluebells (*Mertensia virginica*) infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Shamrock (*Oxalis*) infected with filamentous & spherical virus particles.



Detection method: Electron microscopy,  
University of Minnesota, Plant Disease Clinic.

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Japanese pachysandra 'Green Carpet' (*Pachysandra terminalis*) with alfalfa mosaic virus (AMV) and an unknown filamentous virus.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Peony 'Sarah Bernhardt' (*Paeonia*) infected with tobacco rattle virus (TRV).



Wisconsin Pest Survey Report

Gallery of Plant Virus Symptoms

Peony (*Paeonia*) infected with tobacco rattle virus (TRV).



Peony 'Yellow Crown'



Peony 'Edens Perfume'

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Peony (*Paeonia*) infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Peony 'Momoyama' (*Paenia suffruticosa*) infected with unknown virus.



Filamentous virus particles of 500-600nm length observed with electron microscope (TEM) at University of Minnesota.

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## Gallery of Plant Virus Symptoms

Beardtongue (*Penstemon*) infected with impatiens necrotic spot virus (INSV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Petunia 'Portunia Plus Papaya' (left) and 'Sweetunia Orange Flash' (right) infected with tobacco mosaic virus (TMV).



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Petunia 'Sunflower Ray' infected with tobacco mosaic virus (TMV).



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**Gallery of Plant Virus Symptoms**

Petunia 'Cobalt Blue' (left) and 'Pink Lemonade' (right) infected with TMV.



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Phlox 'Orange-Red' infected with a potyvirus.



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Phlox 'Peppermint Twist' infected with TRV.



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Phlox 'Pink Lady' infected with  
CMV and TRV.



Phlox infected with a  
potyvirus and TRV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Jacob's ladder (*Polemonium caeruleum*) infected with impatiens necrotic spot virus (INSV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Jacob's ladder (*Polemonium caeruleum*) infected with INSV.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Yellow moss rose (*Portulaca oleracea*) infected with papaya mosaic virus (PapMV).



Detection method: ELISA (Agdia, Inc.).

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## Gallery of Plant Virus Symptoms



'Black Satin' Blackberry  
(*Rubus subgenus Watson*)  
with virus symptoms.  
Note: *Rubus* is host to over 40 viruses.

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## Gallery of Plant Virus Symptoms

Britton's wild petunia (*Ruella simplex*) 'Purple Showers'  
infected with tobacco rattle virus (TRV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms



Elderberry with undetermined virus causing ringspot symptoms.



Elderberry 'Yellow Leaf' (*Sambucus*) infected with filamentous & spherical virus particles (University of MN).

# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Pincushion flower (*Scabiosa*) infected with tobacco rattle virus (TRV).



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Stonecrop (*Sedum*) infected with cucumber mosaic virus (CMV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Stonecrop 'Strawberries and Cream' (*Sedum*) infected with undetermined potyvirus.



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms



Stonecrop 'Matrona' (*Sedum*) also on 'Maestro'  
infected with undetermined potyvirus.

# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Spirea (*Spiraea japonica*) infected with spiraea yellow leafspot virus (SYLSV) and spiraea leafspot spherical virus (SLSSV).



Detection method: Electron microscopy,  
University of Minnesota, Plant Disease Clinic.

# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Celandine poppy (*Stylophorum diphyllum*) infected with tobacco rattle virus (TRV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Lilac (*Syringae*) foliar symptoms commonly observed but no virus has been detected.



Detection method: Electron microscopy, University of Minnesota, Plant Disease Clinic.

*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

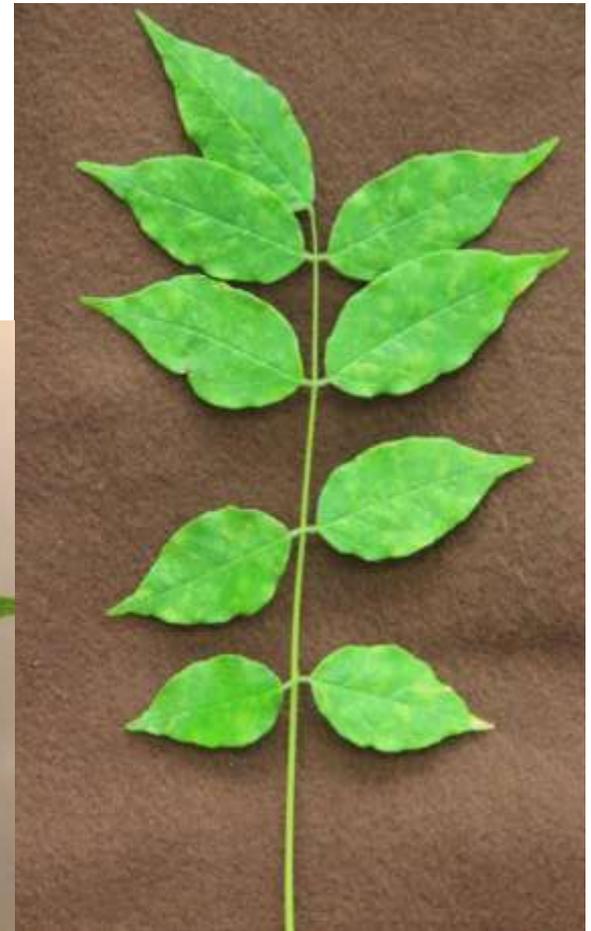
Wisteria infected with wisteria vein mosaic potyvirus (WVMV).



# Wisconsin Pest Survey Report

## Gallery of Plant Virus Symptoms

Wisteria 'Aunt Dee' (*Wisteria macrostachya*)  
infected with wisteria vein mosaic virus (WVMV).



*Wisconsin Pest Survey Report*

**Gallery of Plant Virus Symptoms**

Zinnia 'Uptown Sunstruck' infected with tomato spotted wilt virus (TSWV).



# *Wisconsin Pest Survey Report*

## Gallery of Plant Virus Symptoms

Virus diagnosis performed at Plant Industry Laboratory unless otherwise noted.

Detection methods for each virus are listed below:

1. Alfalfa mosaic virus – RT-PCR (Martinez et al. Plant Disease (2004) 88:908, 2004).
2. Arabis mosaic virus (ArMV) – Immunostrip (Agdia, Inc.).
3. Cucumber mosaic virus (CMV) - Immunostrip (Agdia, Inc.).
4. Cucumber mosaic virus (CMV) - RT-PCR (Blas et. al. Journal of Phytopathology, 141 (1994) 323-329).
5. Dahlia mosaic virus – PCR detection (M. Nicolaisen, Plant Disease (2003) 87, 945-948).
6. Fig mosaic virus (FMV)-RT-PCR (Elbeaino et al. Journal of General Virology (2009) 90, 1281-1288).
7. Hosta virus X (HVX) - Immunostrip (Agdia, Inc.).
8. Impatiens necrotic spot virus (INSV) - Immunostrip (Agdia, Inc.).
9. Tomato spotted wilt virus (TSWV) - Immunostrip (Agdia, Inc.).
10. Tobacco mosaic virus (TMV) - Immunostrip (Agdia, Inc.).
11. Potyvirus group – RT-PCR and sequencing (Zheng et. al. Plant Pathology (2010) 59, 211–220).
12. Tobacco rattle virus (TRV) – Endpoint and real time RT-PCR (D.J. Robinson (1992) Journal of Virological Methods, 40 (1992) 57-66).

Wisconsin Department of Agriculture, Trade and Consumer Protection

## *Wisconsin Pest Survey Report*

### Gallery of Plant Virus Symptoms

Comments welcome!

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We also wish to thank the scientists at Functional Biosciences, Inc., <http://functionalbio.com/web/index.php>, for providing excellent sequencing services.

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6	Agastache	Acapulco Orange	INSV
7	Ajuga	Gaiety	CMV
8	Alcea rosea	Chaters Double Mix	TRV
9	Alstroemeria		TSWV
10	Anemone tomentosa	Robustissima	TRV
11	Anemone tomentosa	Robustissima	TRV
12	Anemone	Serenade	TRV, nematode
13	Armoracia rusticana		TRV
14	Astilbe arendsii	Fanal	CMV
15	Astilbe arendsii	Fanal	CMV, TRV
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20	Begonia		CMV
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22	Bergenia		TRV
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24	Canna	Crimson Beauty	CaYSV
25	Canna	Banana Punch	CaYSV
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28	Clematis	Dancing Smile, Natascha	CICMoV
29	Clematis	Multi Blue	CICMoV
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31	Dicentra spectabilis		TRV

Slide	Host	Variety	Virus
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54	Hosta	Magic Fire, Krossa Regal, Regal Splendor	TRV
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56	Hosta	Paul's Glory	ArMV, HVX
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90	Polemonium caeruleum		INSV
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92	Rubus subgenus Watson	Black Satin	virus symptoms
93	Ruella simplex	Purple Showers	TRV
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Slide	Host	Variety	Virus
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