

Wisconsin Pest Survey Report

Gallery of Plant Virus Symptoms

<http://pestsurvey.wi.gov>



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 2016, 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 at <http://www.ipmimages.org/browse/Archivethumb.cfm?Arc=8> a Bugwood image archive. 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.

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'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.

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



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



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

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



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



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



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



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



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



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



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

Female root knot nematode
(*Meloidogyne hapla*)



Root knot

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



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



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Astilbe arendsii 'Fanal' infected with CMV and TRV.



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Astilbe infected with tobacco rattle virus (TRV).



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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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Tuberous begonia infected with CMV.



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



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

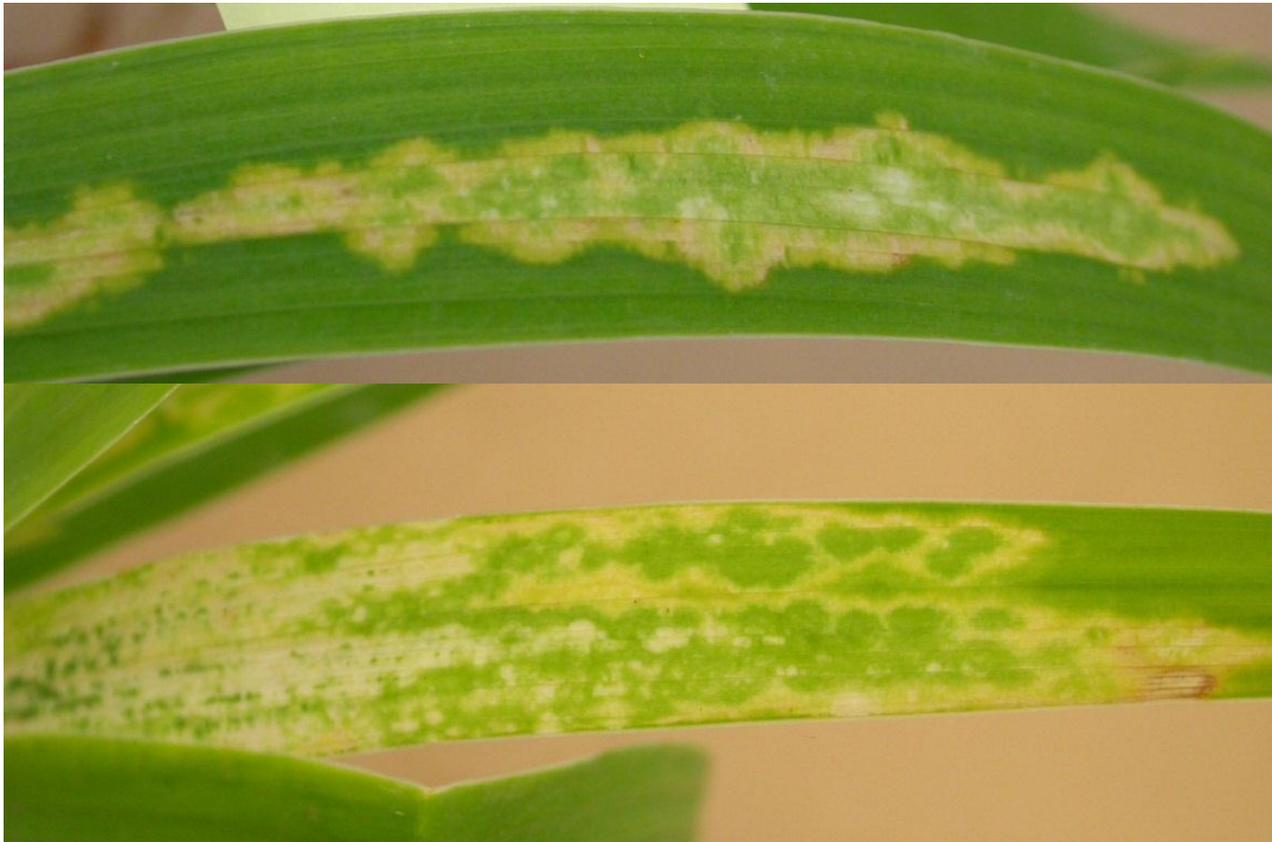


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Blackberry lily (*Belamcanda chinensis*)
infected with tomato spotted wilt virus (TSWV).



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Bergenia infected with tobacco rattle virus (TRV).



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

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



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



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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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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.

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



University MN,
Plant Disease Clinic.

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Clematis 'Multi Blue' left infected with ClCMoV and 'Guernsey Cream' right with TRV.



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Dahlia infected with dahlia common mosaic virus (DCMV).



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



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Larkspur (*Delphinium elatum*) infected with TRV.

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



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Larkspur (*Delphinium elatum*) infected with TRV.



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



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



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



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

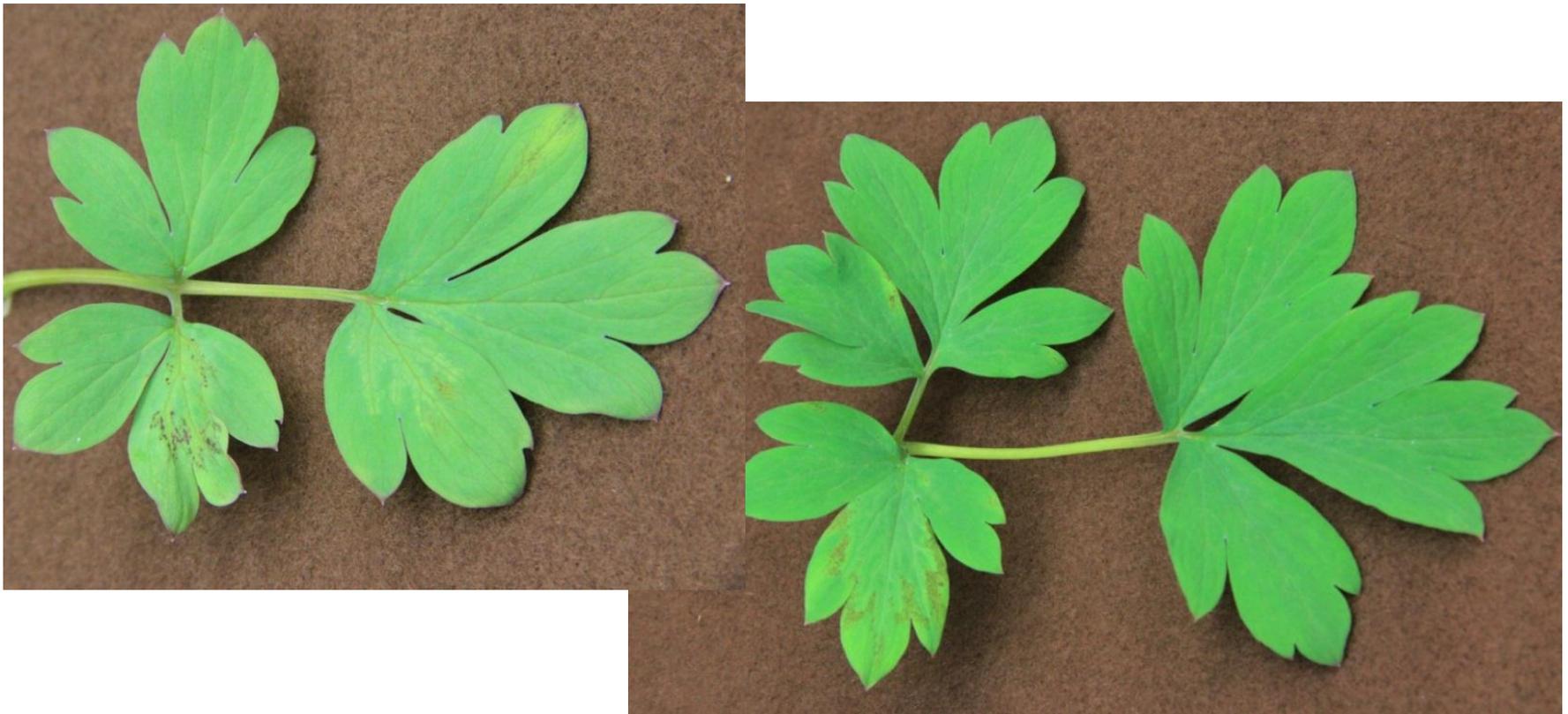


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Bleeding heart 'Pink' (*Dicentra*) infected with CMV and TRV.



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



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Digiplexis (*Digitalis x Isoplexis*) with tobacco mosaic virus (TMV).



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



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Barrenwort infected with tobacco rattle virus (TRV).



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

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



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



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Barrenwort (*Epimedium pubigerum*) infected with TRV.



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



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



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



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

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

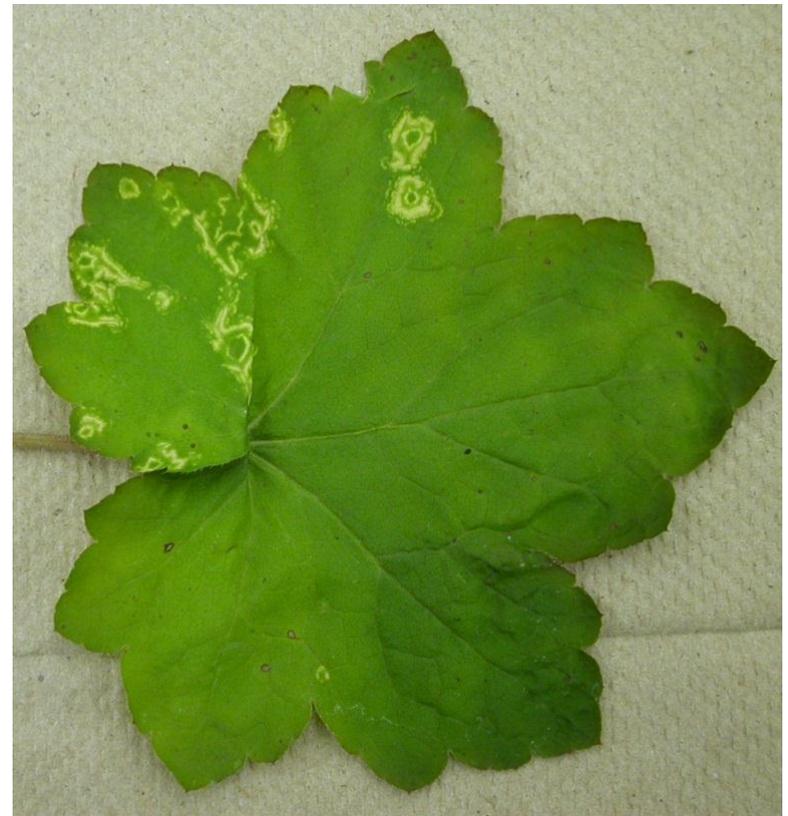
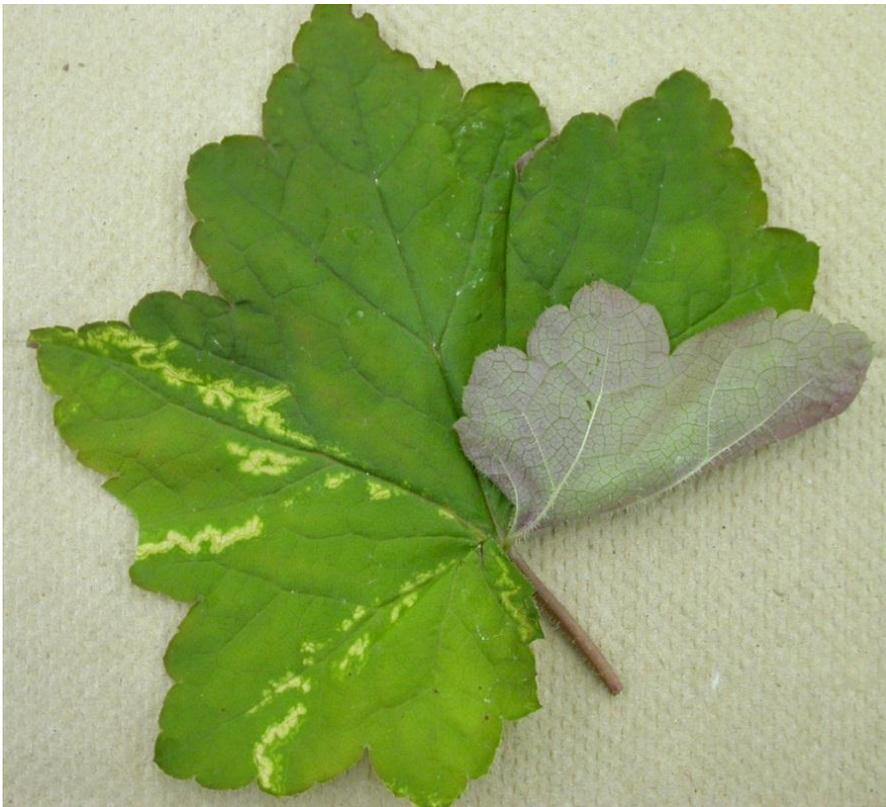


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Coral bells (*Heuchera*) infected with tobacco rattle virus (TRV).



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



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



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Hosta 'Albo-Marginata' infected with HVX.



Hosta 'Daybreak' infected with HVX.



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



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



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Hosta 'Blue Angel'
infected with TRV.



Hosta 'Honeybells'
infected with TRV.

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Hosta
'Magic Fire'



Hosta funkia
'Regal Splendor'



Hosta funkia 'Krossa Regal'

Hosta varieties
infected with
tobacco rattle virus
(TRV).

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Hosta varieties infected with tobacco rattle virus (TRV).



Hosta 'So Sweet'
ringspot pattern symptom.



Hosta 'Christmas Tree'
color bleeding symptom.

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Hosta 'Blue Angel' infected with tomato spotted wilt virus (TSWV).



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



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



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



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



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



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



Detection Method: ELISA, Ohio Department of Agriculture.

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



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



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



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

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



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



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



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



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

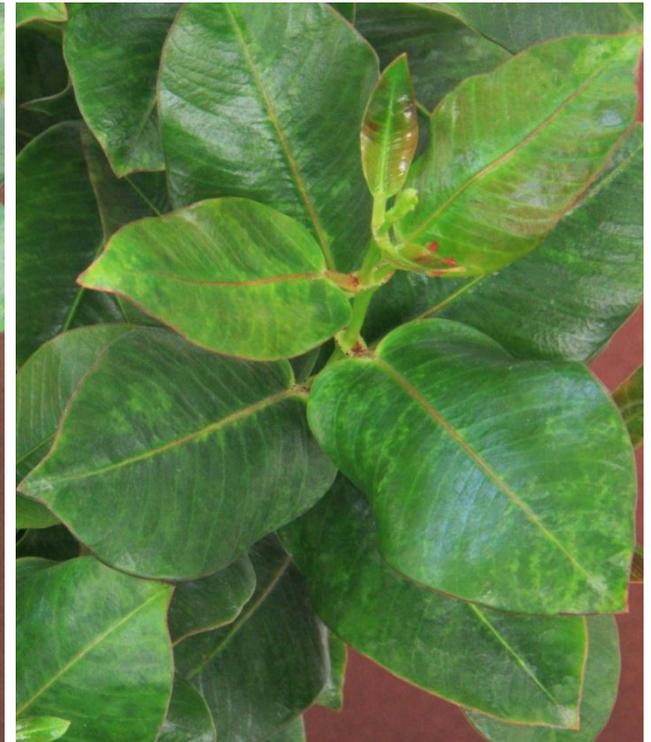


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Mandevilla 'Red Riding Hood' (*Mandevilla sanderi*)
infected with cucumber mosaic virus (CMV).



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

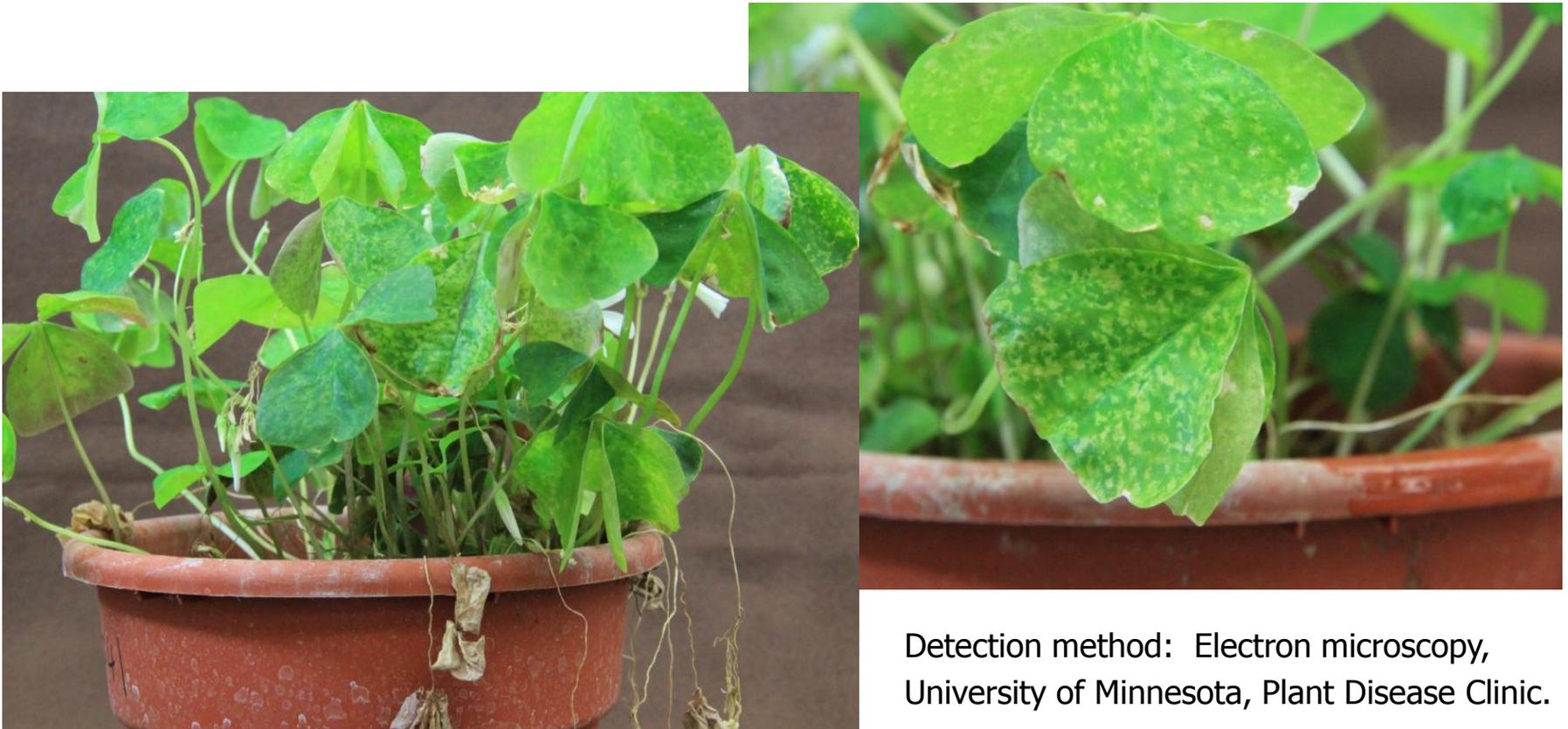


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Shamrock (*Oxalis*) infected with filamentous & spherical virus particles.



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

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



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



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



Peony 'Yellow Crown'



Peony 'Edens Perfume'

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



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



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



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



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



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Phlox 'Pink Lady' infected with
CMV and TRV.



Phlox infected with a
potyvirus and TRV.



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Phlox 'Orange-Red' infected with a potyvirus.



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Phlox 'Peppermint Twist' infected with TRV.



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



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



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



Detection method: ELISA (Agdia, Inc.).

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

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



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Elderberry with undetermined virus causing ringspot symptoms.



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

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



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



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



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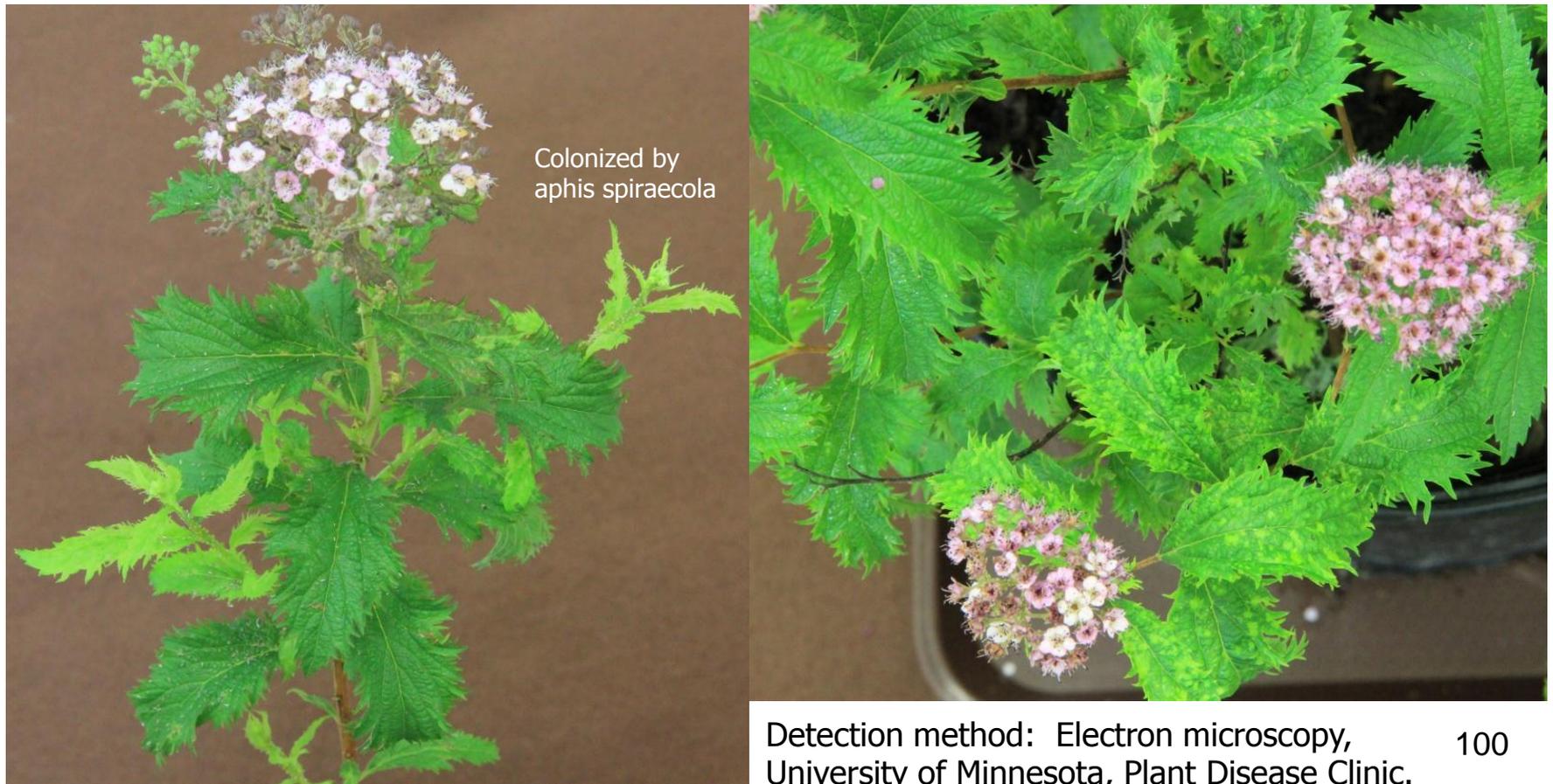
Stonecrop 'Matrona' (*Sedum*) also on 'Maestro' infected with undetermined potyvirus.

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



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



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Lilac (*Syringa vulgaris*) infected with lilac leaf chlorosis virus (LLCV).

Image by M. Wensing, DATCP

Detection: D. Mollow USDA ARS

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Wisteria infected with wisteria vein mosaic potyvirus (WVMV).

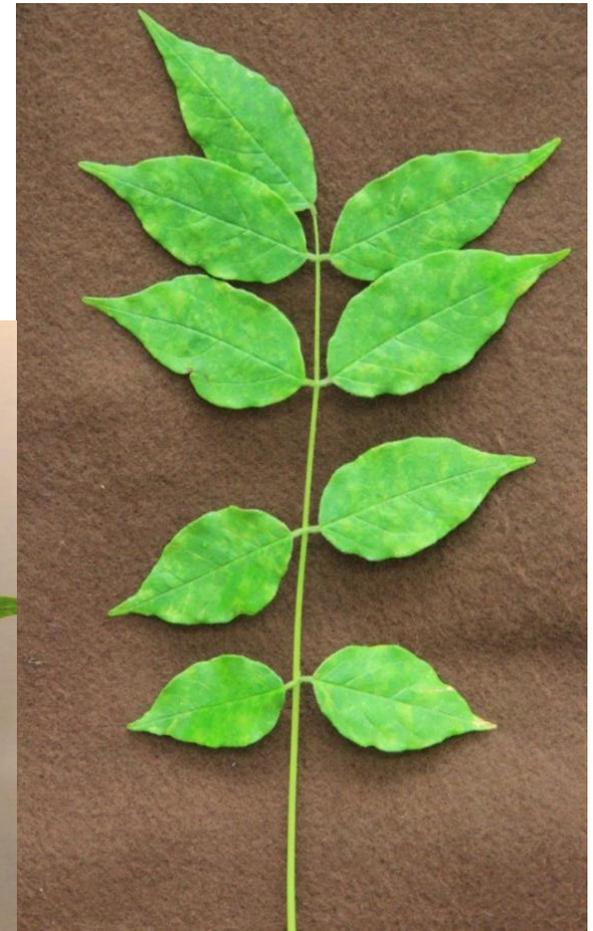


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Wisteria 'Aunt Dee' (*Wisteria macrostachya*)
infected with wisteria vein mosaic virus (WVMV).



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



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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).
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

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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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26	Celtis occidentalis		Hackberry island chlorosis
27	Clematis	Dancing Queen, Dancing Dorian	CICMoV
28	Clematis	Dancing Smile, Natascha	CICMoV
29	Clematis	Multi Blue, Guernsey Cream	CICMoV, TRV
30	Dahlia		DCMV

Slide	Host	Variety	Virus
31	Delphinium elatum	Magic Fountain	TMV
32	Delphinium elatum	Lilac Pink, Magic Fountain	TRV
33	Delphinium elatum		TRV
34	Dicentra spectabilis		TRV
35	Dicentra spectabilis		TRV
36	Dicentra spectabilis		TRV
37	Dicentra spectabilis		TRV
38	Dicentra spectabilis		CMV, TRV
39	Dicentra spectabilis		CMV, TRV
40	Digiplexis		TMV
41	Echinacea purpurea	Magnus	CMV
42	Epimedium	Orange Queen, Elegans, Niveum	TRV
43	Epimedium alpinum	Rubrum	TRV
44	Epimedium pubigerum	Creeping Yellow	TRV
45	Epimedium pubigerum		TRV
46	Epimedium x rubrum		TRV
47	Epimedium x versicolor	Sulphureum	TRV
48	Ficus carica	Black Jack	FMV
49	Gladiolus		BYMV, CMV
50	Helenium	Chelsey	CMV
51	Heuchera		TRV
52	Hosta	Albo-Marginata	ArMV
53	Hosta	Paul's Glory	ArMV, HVX
54	Hosta	Albo-Marginata, Daybreak	HVX
55	Hosta	Sum & Substance	HVX
56	Hosta	Undulata	HVX, TRV
57	Hosta	Blue Angel, Honeybells	TRV

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Slide	Host	Variety	Virus
59	Hosta	Christmas Tree, So Sweet	TRV
60	Hosta	Blue Angel	TSWV
61	Hoya carnosa		INSV
62	Iris	Dwarf German	ISMV
63	Iris	Avalon Sunset	TRV
64	Ligularia		TSWV
65	Lilium	Scarlet Delight	LMoV
66	Lilium	Casablanca	LYLSV
67	Lilium oriental	Angelique	TRV
68	Lobelia		CMV
69	Lobelia		undetermined virus
70	Lobelia sp.	Ruby Slippers	CMV, TRV, TuMV
71	Lupinus hybrid	Minarette	TSWV
72	Lychnis x arkwrightii	Vesuvius	INSV
73	Lysimachia		INSV
74	Mandevilla	Fury Fancy Pink, Teepee Mini Pink	CMV
75	Mandevilla sanderi	Red Riding Hood	CMV
76	Mertensia virginica		TRV
77	Oxalis		undetermined virus
78	Pachysandra terminalis	Green Carpet	AMV & undetermined virus
79	Paeonia	Sarah Bernhardt	TRV
80	Paeonia	Yellow Crown, Edens Perfume	TRV
81	Paeonia		TRV
82	Paeonia suffruticosa	Momoyama	undetermined virus
83	Penstemon		INSV
84	Petunia	Portunia Plus Papaya, Sweetunia Orange Flash	TMV
85	Petunia	Sunflower Ray	TMV
86	Petunia	Cobalt Blue, Pink Lemonade	TMV

Slide	Host	Variety	Virus
86	Petunia	Cobalt Blue, Pink Lemonade	TMV
87	Phlox	Pink Lady	CMV, TRV, potyvirus
88	Phlox	Orange-Red	potyvirus
89	Phlox	Peppermint Twist	TRV
90	Polemonium caeruleum		INSV
91	Polemonium caeruleum		INSV
92	Portulaca oleracea		PapMV
93	Rubus subgenus Watson	Black Satin	virus symptoms
94	Ruella simplex	Purple Showers	TRV
95	Sambucus	Yellow Leaf	undetermined virus
96	Scabiosa		TRV
97	Sedum		CMV
98	Sedum	Strawberries and Cream	potyvirus
99	Sedum	Matrona, Maestro	potyvirus
100	Spiraea japonica		SYLSV, SLSSV
101	Stylophorum diphyllum		TRV
102	Syringae		LLCV
103	Wisteria		WVMV
104	Wisteria macrostachya	Aunt Dee	WVMV
105	Zinnia	Uptown Sunstruck	TSWV
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