



Tobacco Rattle Virus (TRV) on Ornamental Plants

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Introduction

Tobacco rattle virus (TRV) is a plant virus with a large host range (>400 plant species), including many ornamental plants, vegetables, field crops, and weed hosts (Table 1). TRV's host range includes many popular ornamental plants, such as aster, bigleaf hydrangea, bleeding heart, hosta, peony, and petunia, which makes TRV a serious concern for ornamental plant growers and the horticulture industry.

Symptoms

Symptoms of TRV include ringspots (Figs. 1, 2, and 3), line patterns (Fig. 4), mosaic, mottle (Fig. 5), necrotic lesions, and stunting. On ornamental hosts, line patterns and ringspot symptoms are most commonly observed. TRV-infected plants may also be asymptomatic (i.e., show no symptoms). Symptoms of TRV are typically expressed under cooler environmental conditions, whereas under warmer temperatures, TRV-infected plants may be asymptomatic.



Fig. 1. TRV-infected anemone (*Anemone* sp.) showing ringspot symptoms (Photo by M.A. Hansen, Virginia Tech).



Fig. 2. Peony (*Paeonia* sp.) showing ringspot symptoms of TRV (Photo by M.A. Hansen, Virginia Tech)

Table 1. Abbreviated List of Most Common TRV Hosts^{1,2}

Annuals	Perennials	Weeds
Beets	Aster	Cocklebur
Onion	Bleeding Hearts (<i>Dicentra spp.</i>)	Common Chickweed
Pepper	Gladiolus	Purslane
Potato	Iris	
Spinach	Peony	
Sunflower	Tulips	
Tobacco	<i>Allium spp.</i>	
	Blackcurrant (<i>Ribes nigrum</i>)	
	Coral Bells (<i>Heucheras</i>)	
	Daffodil (<i>Narcissus spp.</i>)	
	Epimedium	
	Hyacinth	
	Sedum	
	And many more...	

1 Note that this host list is not comprehensive

2 This list was compiled using the Encyclopedia of Plant Viruses and Viroids, 2019



Fig. 3. Ringspots on TRV-infected false goat's beard (*Astilbe sp.*). (Photo by Anette Phibbs, WI Department of Agriculture, Trade and Consumer Protection, Bugwood.org.)



Fig. 4. Bleeding heart (*Dicentra spectabilis*) with line pattern and mottle symptoms of TRV (Photo by E. A. Bush, Virginia Tech).



Fig. 5. Peony (*Paeonia* sp.) with mottle and ringspot symptoms of TRV (Photo by E.A. Bush, Virginia Tech).

Transmission of TRV

TRV is an RNA virus transmitted by soil-inhabiting stubby root nematodes, which are plant parasitic nematodes that feed on the roots of plants (Robinson and Harrison, 1989). Through root feeding, the nematodes may both acquire and spread the virus to new host plants. The virus can also be seedborne or spread mechanically via plant sap-contaminated tools and/or hands used to propagate, graft, or divide TRV-infected plants

Management

There are no curative controls for plant viruses, other than removing infected plants. Thus, avoidance and prevention of TRV are recommended:

- Plants diagnosed with TRV should be removed to avoid spread to other susceptible plant hosts. Line patterns and other symptoms of TRV are typically not distributed uniformly on plants, but a TRV infection may be systemic, so removing whole plants, including roots, is necessary to eliminate the virus from a greenhouse or landscape (Fig. 6).
- There are no controls for stubby root nematodes in the home landscape/garden, so avoid planting susceptible plants in a landscape, garden, or field where TRV has been diagnosed.
- Manage weeds, as many, such as lambs' quarters, hairy nightshade, and broadleaf plantain, are hosts to TRV and may carry the virus.
- Use disease-free seed.
- Propagate and/or make divisions from disease-free stock plants and disinfect tools frequently and between plants when propagating (Table 2). Wash hands in hot soapy water between plants or, even better, wear disposable gloves and change them between plants.



Fig. 6. Notice that the line pattern and mottle symptoms on this TRV-infected bleeding heart (*Dicentra spectabilis*) are not uniformly distributed on the foliage of this landscape plant (Photo by E. A. Bush, Virginia Tech).

Table 2. Disinfectants Effective for Virus Elimination.

Disinfestant	Active Ingredient	Solution (metric)	Solution (U.S.)	Restricted Use	Notes
Nonfat dry milk (20% solution, weight to volume)	34.78% protein	20 grams dry milk per liter of water	0.71 oz in 33.8 oz water	No	Safe, economical, and non-corrosive
Household bleach (10% solution)	5.25% sodium hypochlorite (NaOCl)	100 milliliters per liter water	3.4 oz in 33.8 oz water	No	Corrosive
Vikron™ S (2% weight per volume solution)	21.41% potassium peroxymonosulfate and 1.5% sodium chloride	Refer to the product label for dilution instructions	N/A	Commercial greenhouse only	Corrosive Most effective options for commercial growers

The disinfectants listed in the table have been shown to be effective in eliminating several viruses from tools with a short contact time (i.e., simply dip the tool in the solution) [Li et al. 2015]. Prior to disinfection treatment, tools should be washed free of any plant/soil or other debris. For corrosive disinfectants, it is important to rinse tools after use.

References

Bonkowski, J. 2021. Tobacco Rattle Virus (TRV). Purdue University Landscape Report, Issue 21-07.
<https://www.purduelandscape.com/article/tobacco-rattle-virus-trv/>

Li R., Baysal-Gurel F., Abdo Z., Miller S.A., Ling K.S. 2015. Evaluation of disinfectants to prevent mechanical transmission of viruses and a viroid in greenhouse tomato production. *Virology* 512:5. doi: 10.1016/j.virol.2015.04.023
<https://pubmed.ncbi.nlm.nih.gov/25623384/>.

Robinson, D.J. and Harrison, B.D. 1989. Descriptions of Plant Viruses: Tobacco rattle virus, DPV No: 346.
<https://www.dpvweb.net/>

Diagnosing This and Other Plant Diseases

This disease may look like a variety of other viruses/ diseases. The Virginia Tech Plant Disease Clinic can test for this and other plant diseases. The Plant Disease Clinic uses highly sensitive and specialized molecular methods to test for this virus. The whole plant should be sent as a sample if possible. If the TRV-suspect plant is grown in soil, a pint of soil from the plant's root zone can be collected to check for the presence of stubby root nematodes, which can transmit the virus to susceptible host plants in the area. Refer to the Plant Disease Clinic website (<https://bit.ly/VTplantclinic>) for the current diagnostic form, fees, and instructions on collecting an appropriate diagnostic sample and submitting samples to the Plant Disease Clinic.



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