

***Spiranthes Mosaic Virus 3 and Bidens Mottle Virus, Two Potyviruses Detected in Phlox divaricata*¹**

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INTRODUCTION: *Phlox divaricata*, also known as blue woodland phlox or wild sweet William, is one of several *Phlox* species grown in the ornamental trade for use as bedding plants. Most are vegetatively propagated. Ten different viruses infecting various species of *Phlox* including *P. divaricata* were reported in a single publication ([Hammond and Reinsel 2011](#)). In one case, five different viruses were found in one plant. In 2012, several plants of *P. divaricata* with virus-like symptoms (Fig. 1) were sent to the Division of Plant Industry for diagnosis. Two potyviruses were identified in these plants, *Spiranthes mosaic virus 3* (SpiMV3) and *Bidens mottle virus* (BiMoV).



Fig. 1. Leaf symptoms of mosaic, downward curl and purpling seen in a sample of *Phlox divaricata*. Photography credit: Mariana Beckman, FDACS-DPI.

THE VIRUSES AND THEIR HOST RANGES: SpiMV3 was originally found in the terrestrial orchid *Spiranthes cernua* in 2006 ([Guaragna et al. 2006](#)) along with a second potyvirus, *Spiranthes mosaic virus 2* (SpiMV2). SpiMV3 is known to have limited host range that only includes *S. cernua* and several *Phlox* spp. ([Hammond and Reinsel 2011](#)). BiMoV, also a potyvirus, was first reported in Florida in 1968 ([Christie et al. 1968](#)). BiMoV has a fairly large host range which includes the weed *Bidens pilosa* (Spanish needle), a number of other Asteraceae including *Lactuca sativa* (lettuce), *Cichorium endivia* (escarole and endive), *Zinnia elegans* and *Helianthus annuus* (sunflowers). In addition, it has been found to infect *Petunia x hybrida* (Solanaceae), and *Verbena x hybrida* (Verbenaceae) ([Logan et al. 1984](#)). Since 2000 BiMoV has been found in *Vicia faba* (Leguminaceae) ([Baker et al. 2001](#)), *Solanum viarum* (Tropical soda apple) ([Baker et al. 2007](#)), *Ammi majus* (Apiaceae) ([Baker et al. 2008](#)) and now *Phlox divaricata* (Polemoniaceae).

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DETECTION AND DIAGNOSIS: Viral inclusions of one or more potyvirus were seen [in leaf strips](#) (Fig. 2) of the *Phlox* plants sent to DPI. Consequently plants were tested with degenerate potyvirus primers. In addition, a host range that included *Nicotiana benthamiana* was mechanically inoculated with leaf tissue from the symptomatic *Phlox* plants. The inoculated *N. benthamiana* showed viral symptoms and a leaf of that plant was also tested with the potyvirus primers. The phlox plants were diagnosed with the potyvirus SpiMV3 and the tobacco plant was diagnosed with the potyvirus BiMoV by sequencing of the PCR products (SpiMV3 does not infect *N. benthamiana*. BiMoV does).

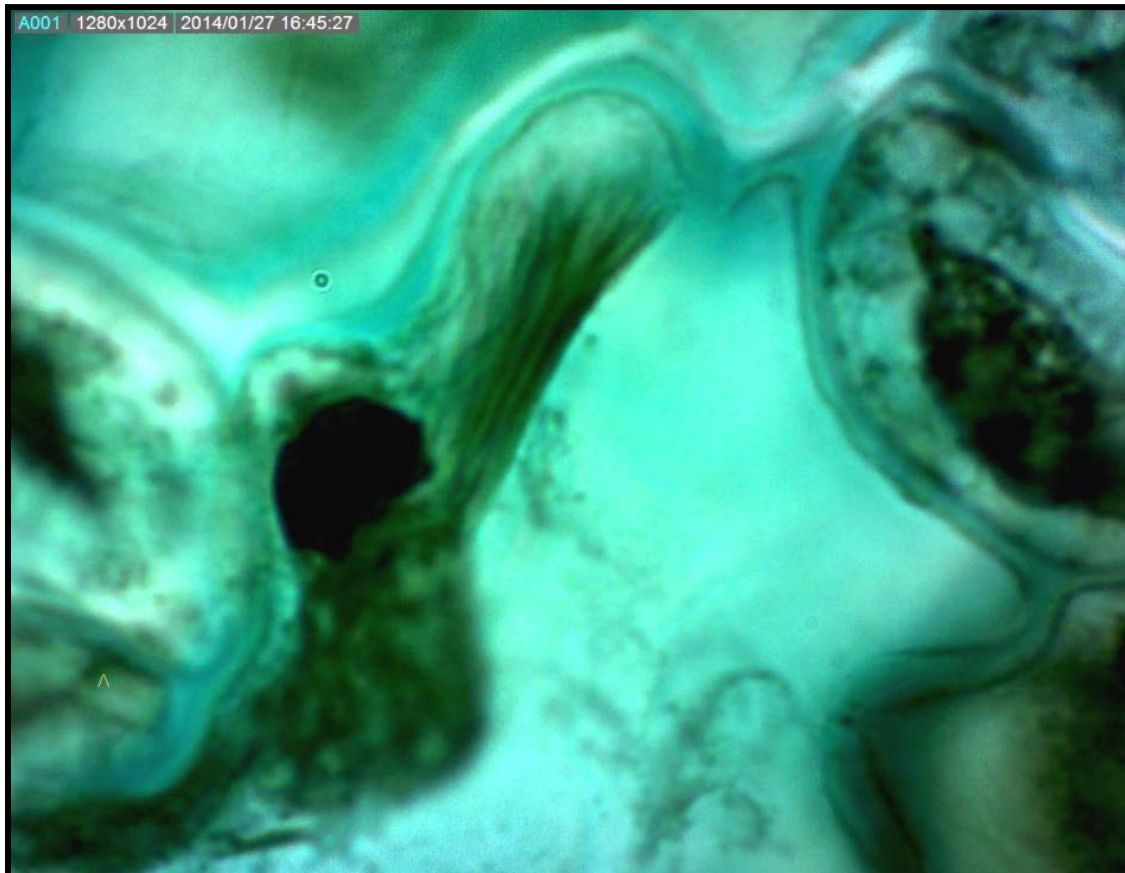


Fig. 2. Epidermal cells of *Phlox* stained with the protein Orange-Green stain. Two types of inclusions are seen next to the darkly stained nucleus. Both inclusions are accumulations of the [cylindrical inclusion proteins of a potyvirus](#). (The inclusions did not stain in the nucleic acid stain Azure A. The failure of Azure A to stain the inclusions is diagnostic for a potyvirus.) Photography credit: Dr. C.A. Baker.

VIRUS SPREAD AND CONTROL: Both SpiMV3 and BiMoV are vectored by aphids; however, insects are probably not the major source of virus spread in *Phlox* species. The major means of virus spread is the vegetative propagation of these plants, a fact that also contributes to multiple virus infections.

[Vegetative propagation](#) is the major means of plant reproduction in the ornamental industry. Increasing plants for sale is easier, faster and less expensive by rooting cuttings of popular plants, and the progeny are true-to-type. Unfortunately, if any of the mother plants are virus-infected, it is also easier and faster to increase the number of virus-infected plants. If there is more than one virus in the mother plants, or insects bring in other viruses over time, the number of viruses in the plants can increase with continued vegetative propagation if clean techniques are not used.

Since there are no antiviral products that can cure a plant of a viral infection once it is infected, the only means of controlling virus spread is vigilance. Cuttings should only be made from virus-free plants. These can be maintained by frequent virus testing, isolation of mother plants, good insect control measures and hygienic propagation methods. Plants found to be virus-infected should be quickly destroyed.

SUMMARY: *Spiranthes mosaic virus 3* is yet another new virus found in Florida and *Phlox divaricata* is yet another host for *Bidens mottle virus*. These findings are also another example of multiple virus infections found in plants that are vegetatively propagated and the need for growers to be aware how important clean propagation methods are to their bottom line.

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