

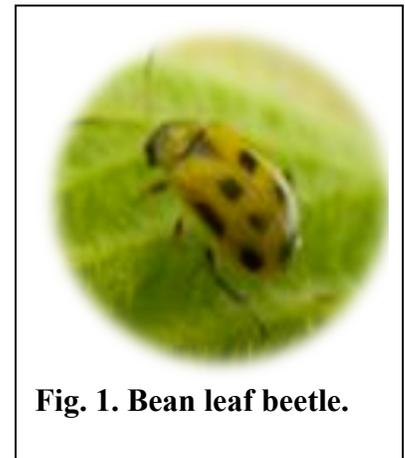
## Bean Pod Mottle Virus in Virginia Soybeans

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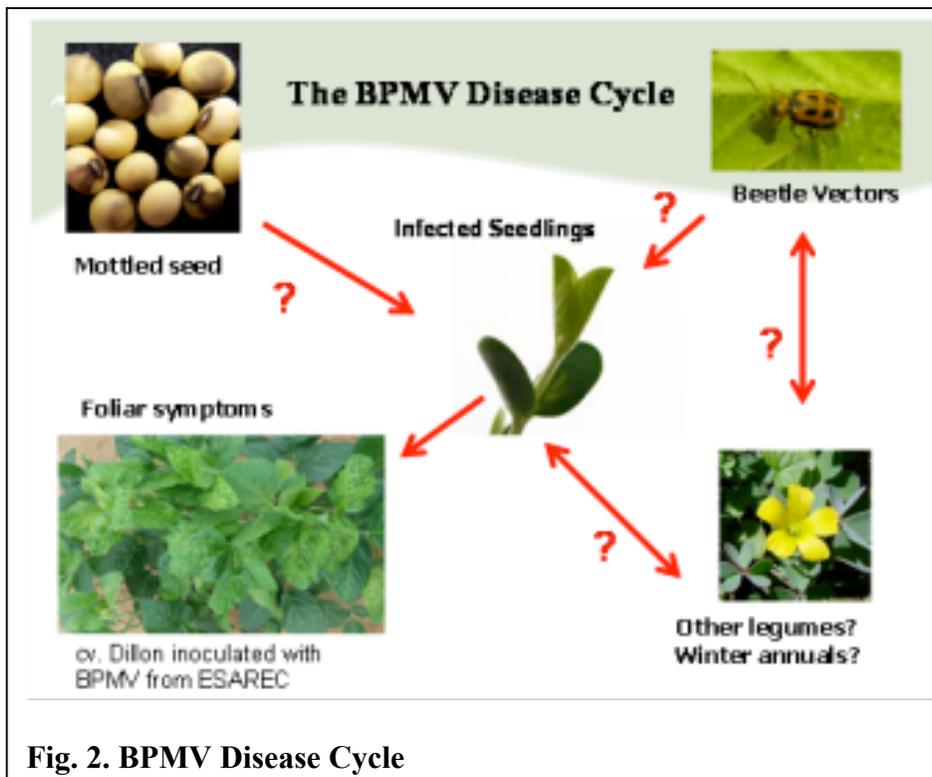
Bean pod mottle virus (BPMV) causes a disease of soybeans. The disease cycle in Virginia is still under investigation to find the primary source of the virus; however we do know that the virus is spread by the bean leaf beetle (Fig. 1). BPMV causes reduction in yields as well as reduced seed quality.

### Symptoms

The visible symptoms of BPMV in soybeans are crinkled leaves with a mosaic of light and dark green regions (Fig.2). Seeds produced on infected plants often show a dark streaking, or “mottle” of the hilum. In areas where BPMV incidence is high, yield reductions between 10% and 40% have been reported. Earlier plant infection results in greater chance of yield loss.



**Fig. 1. Bean leaf beetle.**



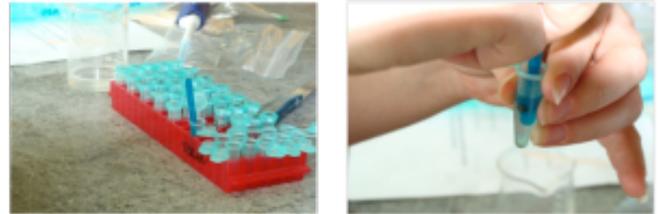
**Fig. 2. BPMV Disease Cycle**

The Midwest has a higher prevalence of BPMV than the Eastern US. This virus, however, seems to be reemerging in Virginia, Maryland and Delaware. In Virginia the disease is found mostly in the eastern part of the state (Fig. 3) with a high prevalence on the Eastern Shore and Northern Neck (Table1). By investigating the possible sources of the virus, the disease may be managed to minimize impact on Virginia soybeans.

**BPMV Prevalence on the Eastern Shore**

Bean leaf beetles collected in 2008 and 2009 on the Eastern Shore of Virginia were tested for BPMV by ELISA (enzyme-linked immunosorbent assay). Assays in 2008 determined that over 80% of the beetles from the Eastern Shore AREC carried the virus on their mouthparts. In 2009 a total of 544 beetles from Accomack and Northampton counties were tested individually for BPMV by ELISA. Of these, 222 (41%) were positive for BPMV. Of 38 soybean fields tested in 2009, 24 fields had BPMV positive beetles and 14 had positive leaf tissue by TBIA (Fig.4) (Table 1). Accomack County had a higher percentage of infected leaf tissue and beetles than did Northampton County. In addition, fields from the Eastern Shore of Maryland as well as the Northern Neck of Virginia also had BPMV positive fields. Limited sampling in the Tidewater area of Virginia did not detect virus infected beetles and soybeans.

**Beetle Processing for ELISA**



ELISA performed with Agdia BPMV alkaline phosphate conjugated antibody, and trapping antibody courtesy of M. Redinbaugh, OARDC.

**2009 BPMV Surveyed Counties**

County	Positive Fields/ Total Tested	ELISA-Positive Beetles/Total Fields
Accomack	9 / 21	14/21
Northampton	5 / 17	10/17
Richmond	5 / 5	5/5
Essex	5 / 5	5/5
Middlesex	0 / 2	nt
Gloucester	1 / 1	nt
Suffolk	0 / 2	nt
Worcester (MD)	2 / 6	nt

Table 1.

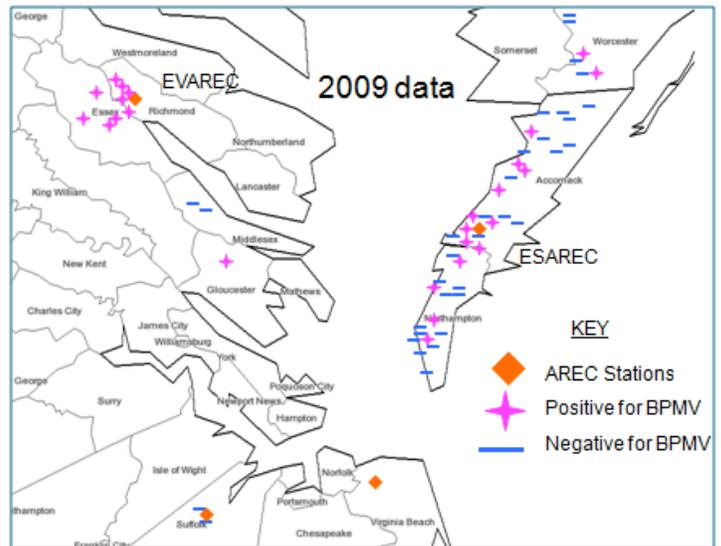


Fig. 3. Locations where BPMV was sampled in 2009.

**Fig. 4 TBIA for Foliage**

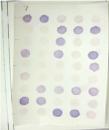


**1. Locate suspicious plant**



**2. Roll and tear leaf**

**5. BPMV positive leaf sap is purple**



Reagents courtesy of Agdia, Inc., in collaboration with Legume ipm/PE and research of S. Tolin and C. Sutila, Agdia.

**4. Develop membranes**



**3. Blot leaf sap on TBIA paper**

### Possible Sources of the Virus

It is unlikely that the seed stage is responsible for being the viral source due to low disease prevalence in fields early in season. It is possible that winter annual, weedy legumes are the source. In the Midwest, the weed tick trefoil, or Tickerfoil has been shown to be an overwintering source for BPMV. The weed is not found in high abundance in Virginia. Tissue blot immunoassays (TBIA) have shown red sorrel and yellow wood sorrel to be positive for virus on the Eastern Shore of Virginia. Other legumes such as clover and vetch have not tested positive for virus, but need further evaluation.

### Management Tactics

Breeding virus-resistant soybean varieties will likely be the best control tactic in the future. Other strategies that may reduce virus incidence include: 1) Controlling beetle-vector populations in the spring by using nicotinoid insecticide seed treatments or targeted sprays. (Our research has shown that bean seeds coated with nicotinoid insecticides can protect seedlings from beetle feeding until 3<sup>rd</sup> trifoliolate); 2) Adjusting planting date to avoid peak beetle populations when soybeans are young should decrease severity of disease (Fig. 5); 3) Eliminating virus-reservoir host plants (weeds) on the farm; and 4) Decreasing the incidence of seed-borne BPMV by only using clean seed, although incidence of transmission is quite low (< 1 in 1000 seeds). (Select varieties of soybeans that have less mottling).

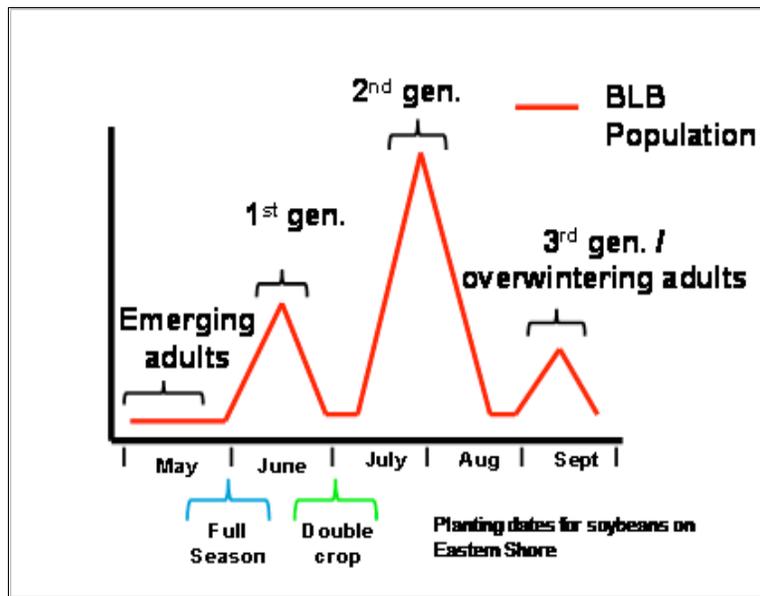


Fig. 5. Seasonal biology of the bean leaf beetle in Virginia.

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