



Michigan Blueberry IPM Newsletter

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Van Buren County

Jersey in Covert is at late fruit coloring and king berries are ripe; in Grand Junction, Blue-ray is within 5 to 7 days of first harvest and Bluecrop is between first and second picking.

Ottawa County

Blue-ray in Holland, and Rubel in West Olive are at late fruit coloring with 7 to 14 days until first harvest, and Bluecrop in West Olive is within 7 days of first harvest.

BLUEBERRY NEWS YOU CAN USE...

Disease management: Continue to scout for newly-formed mummified fruits on the bushes and ground. This will give you an idea of where infections are likely to be greatest next year. As fruit continues to ripen, begin to scout for fruit rots.

Insect management: Japanese beetle numbers are increasing. Fruitworm activity is nearing the end.

2 new blueberry viruses found in Michigan, see page 2-3 for details.

GROWING DEGREE DAYS

From March 1

	2009		Last Year	
	Base 42	Base 50	Base 42	Base 50
Grand Junction, MI				
7/6	1835	1146	1759	1112
7/13	2008	1263	1975	1272
Projected for 7/20	2168	1368	2202	1444
West Olive, MI				
7/6	1652	999	1569	950
7/13	1814	1106	1775	1100
Projected for 7/20	1979	1215	1991	1259

See [MSU Enviroweather website](#) for more information.

Official news release from the Michigan Department of Agriculture**Exotic Blueberry Viruses Found in Michigan***State officials working to rapidly protect Michigan blueberry industry*

Michigan Department of Agriculture (MDA) announced today that exotic blueberry viruses have been detected at several locations in west Michigan. The two viruses, known as blueberry shock and blueberry scorch, were found through routine surveys conducted by both MDA and Michigan State University plant pathologists. Both viruses are known to occur in certain West Coast and mid-Atlantic states where they cause significant losses to blueberry producers. These finds are the first detections in Michigan.

Blueberry shock-infected plants will suffer from loss of foliage and blossoms resulting in yield loss the first year of infection. It's possible that fruit production may resume the next year; however, experts believe this disease could be more severe in this northern climate. The infected plant will serve as a source of infection to other nearby plants since blueberry shock is transmitted mainly through pollinating insects.

Blueberry scorch virus symptoms are similar to shock virus symptoms. In the spring, shoot tips will die back, sometimes on just a few branches. The flowers may blight just as the earliest blossoms open. Scorch infected plants repeat this symptom cycle each spring. The entire bush eventually becomes infected within three years. Fruit production and shoot growth are seriously reduced on scorch infected plants. Scorch is transmitted from plant to plant by aphids. There are no known cures for either of these two diseases.

MDA is working with a team of blueberry experts at MSU to develop a response plan that will protect Michigan's blueberry industry. The initial action will include eradication of the infected plants and then monitoring of nearby blueberry plantings to assure that the disease has been eliminated. MDA and MSU have partnered to assure adequate outreach information on these exotic viruses is provided to blueberry growers. A meeting with blueberry growers is planned for September to review findings from the surveys; and, to discuss means of safeguarding our industry through a systems approach that incorporates science-based best management practices.

Michigan ranks number one in blueberry production in the United States, with over 17,000 acres reported in production. In 2008, Michigan grew 110 million pounds of blueberries which were valued at \$124 million. MDA will be working closely with the state's blueberry industry to eradicate these diseases and safeguard this valuable commodity.

More information:

Regulatory calls to:

Robin Rosenbaum
Plant Industry Section Manager
Michigan Department of Agriculture
517-335-6542

Disease information calls to:

Annemiek Schilder or Jerri Gillett
Department of Plant Pathology
Michigan State University
517-355-7539

OR

Mike Bryan
Nursery Program Manager
Michigan Department of Agriculture
517-241-2977

MSU response to virus detections in Michigan

The recent detection of blueberry scorch and blueberry shock viruses in Michigan blueberry plantings requires a rapid response that is being led by the state's regulatory agency, the Michigan Department of Agriculture.

MSU's blueberry team and the Trevor Nichols Research Complex are working with MDA to help develop the response and implement it effectively over the coming months. As the news release above explains, a plan has been developed to eradicate the sources of these infections and to sample around infected fields to learn more about the extent of infection. At the same time, MSU personnel are developing a plan to provide blueberry growers and the rest of the blueberry industry with information on virus biology, symptoms to look for, and the available management options. A fact sheet prepared by MSU (Virus and Viruslike Diseases of Blueberries, Extension Bulletin E-3048) provides a description and photographs of typical symptoms of these viruses. Information on these viruses can also be obtained from the blueberry website: www.blueberries.msu.edu.

Blueberry scorch virus and blueberry shock virus are present in other regions of the United States, and we are working with Extension colleagues from these regions to learn the latest information on these viruses. A town-hall meeting will be held in West Michigan after harvest in September to present results from the 2009 virus sampling project, and to provide management plans for growers



INSECT MANAGEMENT

Rufus Isaacs & Keith Mason, Department of Entomology, Michigan State University

Cranberry fruitworm flight is essentially over in Van Buren County, and flight of this pest is also declining rapidly in Ottawa County. No eggs were found of either cranberry or cherry fruitworm at the four farms that we sampled, and in general less damage from fruitworm feeding was seen compared with last week. Aphid numbers continue to decline in response to recent insecticide applications. Japanese beetles are out, and numbers are increasing in some fields. There are reports of blueberry maggot fly captures at some farms in Berrien County and southern Van Buren county.

Aphids were found at sampled farms except Covert where an aphid-specific spray had been made, and the percentage of infested shoots has either decreased or remained consistent. Generally we are finding 0 to 15% of new shoots have aphids on them, but some fields have infestations with up to 30% of shoots with aphids. Parasitized aphids (mummies) were found on approximately 5-10% of the new shoots at all of the farms we sampled. Growers and scouts should continue to monitor blueberry aphids and mummies on new growth to help assess the effectiveness of aphid management programs.

Cranberry fruitworm flight has greatly decreased over the past week at all sampled sites. Moths were caught at all four sampled farms and the number caught ranged from 1 to 8 per trap. No cherry fruitworm moths were caught at any of the four farms, and traps for this pest can be removed from fields in preparation for harvest. All four farms were scouted for the presence of fruitworm eggs, and neither cranberry fruitworm nor cherry fruitworm eggs were seen. Early fruitworm feeding

damage has remained low at all sampled farms, and damage has decreased at the Grand Junction farm. This decrease is the result of damaged berries dropping off the bush or being removed during harvest. The fruitworm damage that was seen is from cherry or cranberry fruitworm larvae feeding in a single berry. Webbing together of multiple berries (indicating cranberry fruitworm feeding) was not seen at any of the four sampled farms.

Leafroller larvae and tussock moth larvae were not observed at any of the farms.

No blueberry maggot flies were caught at any of the sampled farms; however, there are reports from growers, scouts and MSU Extension that flies were caught this week in southern Van Buren and in Berrien County. Growers should continue to monitor blueberry maggot flies throughout the harvest period. Be sure to replace traps and ammonium baits as needed.

[For more on blueberry maggot, follow this link to a previous article in the Blueberry IPM Update](#), or see the article in today's edition.

Japanese beetles were observed at four sampled farms except in West Olive. Generally very few beetles were seen in fields because of recent insecticide applications. Beetles and feeding damage were seen on leaves and fruit at the Holland farm. Growers and scouts should continue checking fields for Japanese beetles to ensure that these insects are not present at harvest time. [For more on Japanese beetle, click on this link to see an article from an earlier edition of the Blueberry IPM Update.](#)



Insect Scouting Results

Farm	Date	CFW moths per trap	CBFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Van Buren County						
Covert	7/6	0	3	0%	0	4
	7/13	0	1	0%	0	2
Grand Junction	7/6	0	1	20%	0	0
	7/13	0	0	20%	0	4
Ottawa County						
Holland	7/6	0	21	5%	0	2
	7/13	0	8	5%	0	69
West Olive	7/6	0	13	30%	0	0
	7/13	0	3	30%	0	0

CFW=cherry fruitworm; CBFW=cranberry fruitworm; BBA=blueberry aphid; BBM=blueberry maggot; JB=Japanese beetle

Insecticides for control of blueberry maggot

Rufus Isaacs & John Wise, Department of Entomology, Michigan State University

Adult emergence of the blueberry maggot has already begun over much of the blueberry production region of Michigan. For most blueberry growers, who either have resident populations in their fields or grow in proximity to abandoned or wild blueberry plants, the focus for this point on through harvest is to protect their fruit from infestation. Control of blueberry maggot has been achieved for many years using broad spectrum insecticides. These kill the adult fly on contact and prevent the insect surviving to the point of being able to lay eggs into the fruit. Guthion is highly active against blueberry maggot, with long residual activity and has a 7 day pre-harvest interval. The organophosphates Malathion and Imidan are also effective, with shorter pre-harvest intervals and potential for use closer to harvest. Carbamates such as Sevin and Lannate and the pyrethroids Asana, Mustang Max and Danitol are moderately active on adult fruit flies. As a

general rule, our trials in fruit crops against maggot flies using two week spray schedules have shown lower activity from the pyrethroid chemical class than from the organophosphates. Their performance would be expected to be higher in fields with fewer days between applications.

There are several new insecticide products that include blueberry maggot on their labels. These include the neonicotinoids Provado and Assail that are also active on Japanese beetle and aphids. Our small plot trials of these products have shown that they are effective for protection of fruit from maggot infestation. Additionally, in large-scale trials over four years in Michigan blueberry farms we found no blueberry maggot infestation in fields treated with Provado during July and early August. The spinosyn-containing compounds SpinTor (non-organic formulation), Entrust (organic formulation), and Delegate (BBM suppression)

Table 1. Insecticides for controlling blueberry maggot.

Trade name	Chemical class	Optimal spray timing for BBM	Residual activity	Effectiveness rating**
Guthion, Imidan	organophosphate	within 7 days of first fly captured	14+ days	E
Malathion	organophosphate	within 7 days of first fly captured	5-7 days	G
Lannate, Sevin	carbamate	within 7 days of first fly captured	5-7 days	G
Asana, Danitol, Mustang Max	pyrethroid	within 7 days of first fly captured	7-10 days	G
SpinTor Entrust*, Delegate, GF120 NF	spinosyn	immediately after first fly captured	7-10 days	F-G
Provado, Assail	neonicotinoid	within 7 days of first fly captured	10-14 days	G-E
Surround WP	particle film protectant	multiple applications before fly emergence	as long as thorough coverage of canopy is maintained	G

*OMRI approved for organic production.

**E = excellent; G = good; F = fair

are labeled for blueberry maggot control, but require ingestion by adult flies to be active. In field trials with high pest pressure and two week application intervals their performance has been rated as good (see table 1). Performance would be expected to be higher in fields with lower pressure and with less time between applications, and because these products are sensitive to being washed off, reapplication would be needed after rain or overhead irrigation. These spinosyn-containing products are active on flies and moth larvae (worms), but cannot be relied upon for control of aphids or beetles.

GF120 NF Fruit Fly Bait (spinosad) is registered for control of the blueberry maggot and is listed by the Organic Materials Review Institute (OMRI) for use in organic production. Because the primary route of entry of the insecticide into the insect is through ingestion, applying this product during the fruit fly pre-oviposition period is important for optimal performance. GF120 must be applied with specialized equipment, and is designed for low-volume application by air or by ground. Field efficacy data are encouraging for this product, but we have limited experience with this novel formulation in large-scale trials in Michigan and it is not active on Japanese beetle or aphids that might occur at the same time.

Surround WP is an alternative and organically-approved kaolin clay product for

fruit fly control. The activity of SURROUND for fruit fly control is based on creating a protective barrier between the plant and the pest that 1) reduces host recognition of the pest, and 2) prevents adult oviposition (i.e.; egg laying). Because it is not toxic to adult flies like conventional insecticides, complete coverage of the plant is critical. Multiple applications are typically needed to attain initial coverage of the bush with the kaolin, and further sprays may be necessary afterwards to maintain coverage after wash-off from rain or excessive wind. Field trials indicate that when adequate coverage is maintained, excellent fruit protection can be achieved. However, the white residue on the plant makes this unsuitable for fruit destined for the fresh market, particularly because the residue in the calyx cup of the fruit is so challenging to remove.

Blueberry maggot fly populations are generally distributed unevenly through blueberry plantings. Monitoring for BBM across your farm can help identify hot spots where this pest requires control. By monitoring edge and interior traps for this pest, growers can also understand whether there is only a border infestation and pressure from the surrounding habitat that can be managed using border applications.



DISEASE MANAGEMENT

Annemiek Schilder & Tim Miles, Department of Plant Pathology, Michigan State University

This week all scouted plots were at 5–25% blue fruit. Twig blight symptoms were again reduced in incidence in our scouted plots as compared to last week primarily because of the difficulty in determining this year's twig blight from previous dead wood and by obscuring of some blighted twigs by current-season growth. Symptoms of newly infected mummy berry fruits increased dramatically this week in all of our scouted plots on the bush and on the ground, with the highest average of 98.3 newly mummified fruits being detected at the Grand Junction site.

Mummy Berry

The mummy berry fruit infection develops internally and remains invisible while the berries are green; however, during fruit ripening, the fungus fills the carpels of the fruit and starts to lay down a thick, gray wall in preparation for overwintering (Fig. 1). Sometimes not all carpels are colonized by the fungus, resulting in lopsided or partial mummy berries. Shallow ridges will often appear on the outside of the fruit and the fruit will turn tan brown in color (Figure 2A). In the later stages, the fruit falls to the ground (Figure 2B), although infected berries often remain in fruit clusters in the bush, which causes problems at harvest. In 2007 and 2008 newly mummified fruits on a single bush were strongly correlated with the incidence of apothecia and shoot strikes on that same bush, illustrating that an earlier stage of the disease might be useful at predicting a later stage of the disease.



Fig 1. Cross-section of mummy berry-infected fruit seen on July 9 in Grand Junction.



Fig 2. Newly formed mummified fruits forming on the bush are (A) tan brown in color and have shallow ridges, and (B) will eventually fall to the ground (Grand Junction on July 9).

Scouting for Newly Mummified Fruits

Scouting for newly mummified fruits is important to determine: 1) if your fungicide applications were effective, 2) to assess potential problems with mummy berry at harvest time, and 3) to have an idea of potential disease pressure for next year. To scout for mummy berry, pick ten random bushes spread out in a 2 different rows (5 bushes per row). It is extremely important to not only scout on the bush but also on

the ground as mummies tend to detach from the cluster prematurely. They are easier to see when the ground is clear of weeds and debris. To distinguish infected berries from other types of decay caused by fungi or insects, you can cut them in half and look for the characteristic white to gray fungal growth inside. In addition, when squeezing the mummy berries between thumb and forefinger, they are fairly sturdy with a bit of a rubbery feel or resilience to them. In contrast, "regular" rotting or insect-infested berries would be easy to squeeze to a pulp, disintegrate easily, leak or crumble. Scouting is done ideally before the first harvest.

Disease Scouting Results

Farm	Date	Avg number of mummy berry shoot strikes per bush*	Avg number of newly-mummified fruits**	Avg number of blighted twigs per bush***
Van Buren County				
Covert	7/2	0.0	0.7	12.9
	7/9	--	2.3	8.3
Grand Junction	7/2	0.0	15.3	1.9
	7/9	--	98.3	0.2
Ottawa County				
Holland	7/2	0.0	1.5	3.2
	7/9	--	6.1	1.2
West Olive	7/2	0.0	1.1	10.3
	7/9	--	5.7	2.3

*Average number based on 10 bushes.

**Average based on scouting on and below 10 bushes.

*** Blighted twigs may be caused by various fungi, including *Phomopsis vaccinii*, *Colletotrichum acutatum*, and *Botrytis cinerea*. These numbers are reduced from peak blight observed on June 11–19, 2009.



How to recognize symptoms of blueberry shock and scorch, two new virus diseases found in Michigan

Annemiek Schilder, Department of Plant Pathology, Michigan State University
Mark Longstroth, MSU Extension–Southwest

As a long-established blueberry growing region, Michigan has had its share of virus diseases, such as shoestring, necrotic ringspot, leaf mottle, etc. Recently, two new blueberry viruses were found in Michigan. The diseases they cause are not new since they are present in other growing regions such as the Pacific Northwest, but they are new to Michigan. Fortunately, the infections appear localized and efforts are underway to eradicate them to protect the Michigan blueberry industry. Symptoms of blueberry shock and blueberry scorch can be quite dramatic but may be confused with *Phomopsis* or mummy berry. The main difference is that in the case of shock and scorch, you may just see one or a few

infected bushes in the midst of perfectly healthy bushes. It is important to be able to recognize the symptoms for monitoring and in case of future outbreaks.

Shock (Fig. 3) is caused by blueberry shock virus (BShV) and is common in Oregon, Washington, and British Columbia. Symptoms are very similar to those of scorch, i.e., sudden, complete flower and leaf necrosis during the bloom period. However, unlike scorch, a second flush of foliage occurs and the plants appear quite normal later in the season except for the lack of fruit. Infected bushes often exhibit symptoms for 1 to 4 years and then become symptomless. In the Pacific Northwest,

the bushes eventually recover and a good crop is possible in well-managed fields. However, we cannot assume that this will be the case in a northern climate. Blueberry shock virus is dispersed by infected pollen carried by bees and spreads rapidly in a field. Infection only occurs during the bloom period. Symptomless infected plants remain a source of virus. All tested cultivars are susceptible.

Scorch (Fig.4), caused by the blueberry scorch virus (BIScV) is a serious disease in the Pacific Northwest (Oregon, Washington, and British Columbia) and New Jersey, where it is also known as Sheep Pen Hill disease. Scorch has also been found more recently in blueberries in Massachusetts and Connecticut. Sudden death and complete necrosis of flowers and leaves occurs. Twigs may die back up to 10 cm (4 in.). Scorched blossoms are often retained throughout the summer and may resemble spring frost injury, Phomopsis, or Botrytis blight. Bushes will die in 3–5 years after first showing symptoms. Some cultivars (e.g., Stanley) also show marginal leaf chlorosis. In Sheep Pen Hill disease, leaves may show a red line pattern in the fall. Severe infections can kill the bush. The New Jersey strain causes symptoms in all cultivars except Jersey and apparently Legacy, whereas the West Coast strain is symptomless in Bluecrop and Duke amongst other cultivars. Pale green leaves may be the only symptoms in Bluecrop and Legacy plants. Blueberry scorch virus is transmitted by infected cuttings and aphids. Once a plant is infected, symptoms may take 1 to 2 years to develop. The disease spreads quickly in a radial pattern and eventually all bushes in a field may become infected. The virus spreads readily to neighboring fields but usually not more than 1 km (0.6 miles).

Prevention

Virus diseases are often introduced into new



Fig 3. Symptoms of shock virus.



Fig 4. Symptoms of scorch virus.

areas through infected planting material. Buying virus-free planting stock is the primary preventive measure for virus disease control. It is particularly important not to import planting material from areas where shock and scorch virus are known to occur, unless it has been virus tested. In 2002, the Michigan Department of Agriculture (MDA) established a quarantine for blueberry planting material to prevent the introduction into Michigan of blueberry scorch virus (BIScV), blueberry shock virus (BIShV), and Sheep Pen Hill virus (a strain of blueberry scorch virus designated as BIScV-NJ). MDA quarantine regulations stipulate that no plants, buds, vegetative cuttings or any other blueberry planting material should be brought into Michigan from regulated areas (BC, WA, OR, NJ, MA, CT) unless it has been certified to be virus free by a virus-free certification program recognized by MDA. Planting material shipped into Michigan must be accompanied by a State Phytosanitary Certificate or Certificate of Quarantine Compliance, indicating its point of original propagation or production and labeled or stamped to show compliance with the terms of this quarantine. Violations of the quarantine regulations can lead to fines and destruction of uncertified or virus-infected plant material as well as revocation of the special permit to ship to Michigan.



Funding for this newsletter is provided by grants from the EPA and Project GREEN.

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