Michigan Blueberry I.P.M. Update

June 3, 2008 Volume 2, No. 7

Contents

Next Blueberry IPM Twilight Meeting

When: Wednesday June 11, 2008 *6-8PM*
Where: Cornerstone Ag, 01240 57th St., Grand Junction, MI 49056 (Van Buren County)
What: Timely updates for control of insect, disease, and weed control. This is a free meeting, with a light dinner served at 6PM. Spray credits available for attending. Hope to see you there!

CROP STAGES

Keith Mason
Department of Entomology, Michigan State University

In Van Buren County, Jersey in Covert is at petal fall, and in Grand Junction, Blueray is nearing the end of petal fall and Bluecrop has small green fruit. In Ottawa County, Blueray in Holland, and Rubel and Bluecrop in West Olive are at petal fall.

Jersey at petal fall in Covert (left) and Rubel at petal fall in West Olive (right).

WEATHER NOTES

Mark Longstroth
Michigan State University Extension

Complete weather data for your area can be found at enviroweather.msu.edu.

Last week's temperatures were warmer with highs in the 60s and 70s and lows near 40. There were scattered frosts on Wednesday and Thursday that caused little damage. Significant damage from these freezes was reported in the rest of the state. Friday was windy and cloudy and offered a little rain (varied from a trace to a third of an inch). This was a disease infection period for some areas, depending on where the rains fell. Soils are really drying out and shallow rooted berry crops will benefit from irrigation. The weekend was warm. Temperatures will be cooler for the next couple of days near 70's, with a good chance of rain. We expect hot temperatures at the end of the week with highs in the upper 80's. Our GDD totals still lagging ten days behind normal.

DEGREE DAYS		
GDD (from March 1)	**Base 42**	**Base 50**
	Van Buren County	
5-26-08	715	387
6-2-08	843	467
Projected for 6-9-08	1062	630
	Ottawa County	
5-26-08	598	298
6-2-08	712	364
Projected for 6-9-08	925	522

Pest of the week – Virus and virus-like diseases

Timothy Miles and Annemiek Schilder
Department of Plant Pathology, Michigan State University

Blueberry Shoestring (virus)

Blueberry shoestring is a widespread disease of blueberry, especially in eastern North America, and is caused by the blueberry shoestring virus. Shoestring disease is common in many older Michigan blueberry fields, particularly in 'Jersey' but has also started to spread to 'Elliott'. Shoestring virus is spread from plant to plant by the blueberry aphid (*Illinoia pepperi*) (Figure 1).

Figure 1. Adult blueberry aphid (*Illinoia pepperii)*

Symptoms

Common symptoms include: elongated reddish streaks (3 to 20 mm long) on green stems, especially on the side exposed to the sun; and red or purplish, elongated, strap-like leaves (Figure 2). In addition, leaves may become cupped if one side of the leaf fails to develop. Flowers often can become reddish and fruit may be reddish purple instead of blue at during ripening.

Disease cycle

Blueberry shoestring virus is transmitted by the blueberry aphid (*Illinoia pepperi*). The aphids pick up the virus while feeding on infected plants and then transmit the virus while feeding on healthy plants. Transmission starts in the spring when aphids emerge, and ends in the fall just before leaf drop. Aphids slowly move from infected bushes to neighboring healthy ones as they feed and are also commonly transported down rows by mechanical harvesting equipment.

Figure 2. A) Reddish strap-like leaves caused by blueberry shoestring virus. B) Overall stunting effect of shoestring virus after several years of infection in Holland, MI (right bush).

Management

Destroying infected bushes is recommended but may not be commercially feasible on a large scale. However, old infected 'Jersey' fields should be removed and replaced with new varieties where possible. Spread of the disease may be reduced by controlling the vector, the blueberry aphid. A well-timed insecticide, starting in late May or early June as the aphid population begins to be build up, has been shown to be highly effective. Also washing the harvester between fields to rid the equipment of aphids is recommended. Furthermore, when planting new fields, growers should use virus-tested planting stock as a preventative measure.

Blueberry Stunt (phytoplasma)

Figure 3. A) Shoots with blueberry stunt, showing cupped leaves with light-green to yellow edges and interveinal areas. B) Bushy, stunted shoots of plant infected with blueberry stunt.

Blueberry stunt is a serious and widespread disease of blueberry caused by the blueberry stunt phytoplasma (this is a microorganism related to bacteria and is not a virus). The disease has been found in Michigan and has also been reported to occur in New Jersey, North Carolina, Massachusetts and New York.

Symptoms

Blueberry plants with stunt have bushy branches due to a shortening of the internodes between the leaves (Figure 3). In addition, the leaves are often cupped slightly downward and have chlorotic edges that will turn red in fall. Infected plants
may produce fruit with lower than normal sugar content that ripen late or not at all.

Disease cycle
The blueberry stunt phytoplasma overwinters in the vascular tissue of infected stems and roots. In the spring and early summer, as leaves and shoots develop, the stunting and leaf symptoms become apparent. Stunt is transmitted by sharpnosed leafhoppers. Therefore, infections usually coincide with peaks in leafhopper activity.

Management
Once a plant is infected it is infected for life. Infected plants should be removed and destroyed to prevent them being sources of infection for nearby plants. As with insect-vectored viruses the best control strategy is to apply well-timed insecticides to control leafhopper activity.

Blueberry Leaf Mottle (virus)

Blueberry leaf mottle has only been reported to occur in Michigan and is caused by the blueberry leaf mottle virus.

Symptoms
Leaves show a mottling pattern and may be malformed or straplike. Severely infected Rubel bushes have dead stems, a small amount of regrowth near the crown area, and little to no crop. Jersey or Blueray plants may be stunted and have small, pale, rosetted terminal leaves (Figure 4).

Disease cycle
The virus spreads via infected pollen carried by honeybees from diseased to healthy bushes up to 1 mile. Symptoms do not become apparent until 3 to 4 years after infection.

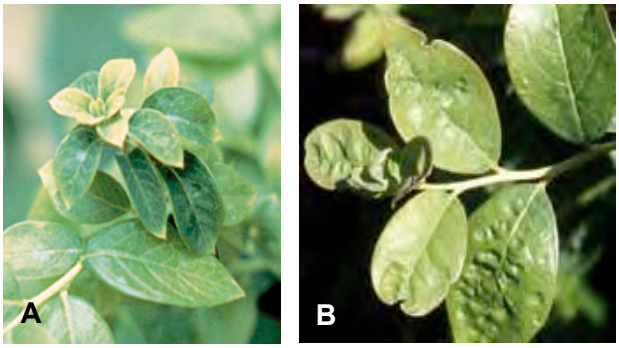

Figure 4. A) Field symptoms of blueberry leaf mottle virus in Jersey plants showing a terminal rosette of leaves. B) Mottling pattern seen in a Michigan blueberry field.

Management
Testing and removing infected bushes that show disease symptoms can decrease the risk of disease spread. Other tips are to ensure that virus-tested planting stock is being used when planting a new field. In addition, if a field is known to have a leaf mottle virus problem do not move bee hives from that area to another healthy field. Place beehives as far as possible from infected areas.

Blueberry Mosaic (unknown, but most likely a virus)

Blueberry mosaic has been observed in most blueberry-growing regions of the United States and Canada. Mosaic spread is probably the result of diseased planting stocks, which are mainly responsible for introducing mosaic into commercial plantings.

Symptoms
Leaves will exhibit a dull to brilliant mottle or mosaic pattern that varies from yellow, pink, or yellow-green (Fig. 5). Symptoms are not always produced every year, and sometimes symptoms depend on sunlight intensity. Fruit on diseased bushes ripens late and is of poor quality.

Figure 5. A) Field symptoms of blueberry mosaic (May 2007 Grand Junction, MI). B) Severe yellow mosaic pattern due to blueberry mosaic.

Disease cycle
No causal organism has been identified, however, a virus is suspected due to the apparent spread from bush to bush.

Management
The main strategy for mosaic disease control is to remove

infected plants from field.

Tomato Ringspot (virus)

Tomato ringspot is caused by the tomato ringspot virus. It primarily is a problem in the pacific blueberry-growing regions of the United States including Oregon and Washington. However, it has been reported in Michigan as well, alone or in combination with tobacco ringspot virus.

Symptoms

Infected leaves are often malformed with numerous circular spots that range from 2 to 5 mm in diameter (Fig. 6A). These necrotic spots can also occur on canes. Symptoms are variable within the same plant. Frequently infected plants will be defoliated during harvest and eventually die. This disease spreads slowly in the field, and after several years a large area of weak or dying plants may develop.

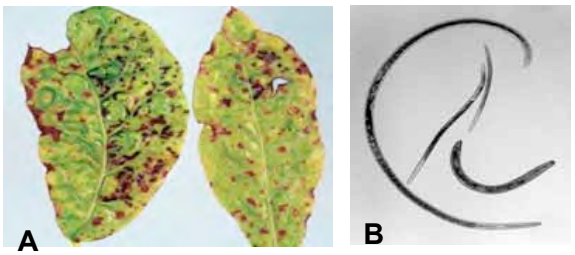

Figure 6. A) Foliar symptoms of tomato ringspot virus showing necrotic circular spots. B) Dagger nematodes (*Xiphinema americanum*)

Disease cycle

The virus is transmitted by the dagger nematode (*Xiphinema americanum*) (Fig. 6B) which has a wide host range, including dandelions, apples, grapes, and raspberries. Tomato ringspot can also be seed-borne. Plants that are produced from these seeds can act as a reservoir of virus for nematodes feeding on their roots.

Necrotic Ringspot (virus)

Necrotic ringspot is caused by the tobacco ringspot virus and occurs sporadically in the northern United States and Canada. This disease has been seen in Michigan blueberry fields in the past.

Figure 7. Necrotic ringspot

Symptoms

Leaves are misshapen, crinkled and covered with small necrotic spots that may cause small holes (Fig. 7). Some cultivars show rosetting of terminal leaves or stem dieback. In all cultivars, infected bushes will slowly decline in growth and yield.

Disease cycle

The disease often times originates from infected planting stock. In the field, it is transmitted by the dagger nematode (*Xiphinema americanum*). The disease spreads about 1 m per year. Infected bushes can be found in a roughly circular pattern from the infection source.

Management

Before planting, test soil for the presence of dagger nematodes and fumigate if the test is positive. When planting, ensure that stock is virus tested. Other important control approaches include: maintaining good weed control, planting resistant cultivars, and removing plants that are symptomatic for tobacco ringspot virus.

Blueberry Red Ringspot (virus)

Blueberry red ringspot is caused by the blueberry red ringspot virus and primarily occurs in the eastern United States. It has also been found in Michigan blueberry fields.

Symptoms

Ring-like red spots (4-6 mm in diameter) or round red blotches first appear on green stems earlier in the season (Fig. 8B). Also, reddish-brown circular spots appear on the upper surfaces of older leaves during mid to late summer (Fig. 8A). These spots are approximately 3-5 mm in diameter. Symptoms may be mistaken for powdery mildew. Furthermore, circular, light-colored blotches can also develop on infected fruit.

Figure 8. Blueberry red ringspot

Disease cycle
Evidence suggests that mealybug is the probable vector of blueberry red ringspot virus. As the disease progresses the infection becomes systemic throughout the plant's tissues. The plant will be infected for life and will serve as a source of infection for nearby bushes.

Management
Some options include planting virus-tested, clean stock and testing and removal of diseased plants from the field. Finally, planting moderately resistant cultivars like 'Bluecrop' and 'Jersey' can be effective at limiting the occurrence of blueberry red ringspot.

INSECT UPDATE

Keith Mason and Rufus Isaacs
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The number of cherry fruitworm and cranberry fruitworm moths in traps at our scouting sites has increased. Cherry fruitworm eggs were found at the West Olive, Grand Junction and Covert farms, but no cranberry fruitworm eggs were seen. Growers at the Grand Junction and Covert farms have applied their first insecticide targeting fruitworm, and the growers at the West Olive and Holland farms will be applying fruitworm sprays this week. We expect the number of both species of fruitworms caught and egglaying by cherry fruitworm to increase over the next week. We expect to find the first cranberry fruitworm eggs this week. Growers and scouts should continue monitoring cherry and cranberry fruitworm traps, and after petal fall, berry clusters should be inspected for eggs and larvae. See below for methods for scouting for fruitworm eggs, larvae and damage.

All farms were scouted for the presence of blueberry aphid, and aphids were found at the West Olive, Holland and Covert farms. Only solitary winged aphids or small colonies (1 to 5 individuals) were seen. No parasitized aphids were seen at any of the farms. Growers and scouts should be looking for this pest particularly on farms with varieties that are susceptible to shoestring virus. See below for scouting methods for aphids.

Other insect activity was low over the past week. Some leafroller feeding was observed at the Grand Junction farm. Climbing cutworm and spanworm feeding was not observed at the scouted farms. Feeding by leafrollers, spanworm and cutworm should remain low now that growers are starting to apply insecticides for fruitworms, as these sprays will generally control other moth pests. The flower feeding beetle *Hoplia trifasciata* was not seen at any of the four farms, but some growers are reporting feeding by these pests. No tussock moth larvae were observed, but growers and scouts should still be on the lookout for this pest. See the May 28th issue of the Michigan Blueberry IPM Update for more on tussock moth.

MONITORING FOR FRUITWORMS
After moths are caught and after petal fall (~5-15 or 5-30) bushes should be inspected for eggs and damage each week for a five minute sampling period. Working in a "hotspot," look at as many fruit clusters as possible on 10 to 20 bushes along the field border. Looking at the fruit clusters can help you find eggs in calyx cup, larval entry holes and damage. When inspecting the fruit grasp the cluster and view with the sun over your shoulder. Carefully turn the clusters over and inspect the bottom of the fruit as well as the top for entry holes and/or frass. Record the number of cranberry fruitworm and cherry fruitworm eggs and the number of berries with damage. **Click here for more info and photos of cranberry and cherry fruitworm.**

SCOUTING FOR APHIDS

Begin scouting for blueberry aphids in early to mid May. Look at 2 shoots of new growth at the base of 10 bushes and check for the presence of aphids on the underside of the leaves. As the season progresses, you should look for parasitized aphids (mummies). Record the number of shoots with aphids on the 10 bushes – 2 shoots per bush (multiply by 5 to get % infested shoots). Do the same for aphid mummies. If aphids are found on varieties that are susceptible to shoestring virus, insecticides may be needed for control. For more info on blueberry aphids, see the insect section of the MSU Blueberry Facts website.

Van Buren County						
Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Covert	5-19	2	1	0		
	5-27	1	2	5%		
	6-2	18	6	10%		
Grand Junction	5-19	1	2	0		
	5-27	0	6	0		
	6-2	2	4	0		
Ottawa County						
Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Holland	5-19	0	0	0		
	5-27	1	4	0		
	6-2	21	3	5%		
West Olive	5-19	0	2	0		
	5-27	0	7	0		
	6-2	1	7	10%		

DISEASE UPDATE

Timothy Miles and Annemiek Schilder
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Mummy Berry

This week all scouted plots were at full bloom to petal fall. This week new and old shoot strike infections were found at higher levels then previous weeks, with the highest incidence being observed at Grand Junction averaging 48.1 shoot strike infections per bush (Figure 1). Higher humidity has caused a lot of gray sporulation to appear on infected tissues. Spores produced from infected shoots are carried by wind or insects to open flowers where the ovaries become infected. Good pollinating weather can mean that a considerable amount of fruit infection occurs despite low shoot strike incidence. Management using a fungicide spray program is important during this period to protect the flower stigma from infection. Systemic fungicides, such as Indar, are the most useful.

Twig Blight

In addition to shoot strikes, blighted twigs have also been observed at low levels over the past few weeks with the highest incidence being observed in Covert averaging 2.2 blighted twigs per bush. This week, the number of blighted twigs increased slightly compared to last week, although incidence has remained relatively low. Blighted twigs may be caused by various fungi, including *Phomopsis vaccinii*, *Colletotrichum acutatum* and *Botrytis cinerea*.

Figure 1. Mummy berry shoot strike symptoms observed at various stages of development A) Newly formed shoot strike

Scouting for twig blights

To scout for blighted twigs, pick five bushes and look for a recent browning and death of young twigs and collapsing flower/fruit clusters. If scouting reveals a moderately high incidence (>20 blighted blossoms/twigs per bush) consider applying a fungicide, especially if rain is in the forecast. Several fungicides are rated good to excellent at controlling the various fungi that cause twig blight, including Indar, and Pristine. In addition, there are several cultural control strategies that can be employed: when plants are dormant, prune out infected canes and avoid wounding the canes. Furthermore, to reduce the spread of spores and infection, minimize overhead irrigation or time irrigation to coincide with natural dew formation to reduce the availability of moisture for infection.

Van Buren County				
Farm	Date	Average number of apothecia on the ground per bush*	Average number of mummy berry shoot strikes*	Average number of blighted twigs per bush**
Covert	5-15	0.0	0.8	-
	5-22	0.0	1.3	2.0
	5-30	-	2.1	2.2
Grand Junction	5-15	0.0	6.8	-
	5-22	0.0	34.1	0.5
	5-30	-	48.1	0.7
Ottawa County				
Holland	5-15	0.0	0.5	-
	5-22	0.0	1.8	0.1
	5-30	-	6.5	0.2
West Olive	5-15	0.7	3.4	-
	5-22	0.0	8.5	0.2
	5-30	-	10.3	0.2

*Average number was calculated for ten bushes.
**Blighted twigs may be caused by various fungi, incl. *Phomopsis vaccinii*, *Colletotrichum acutatum* and *Botrytis cinerea*.

BLUEBERRY CHEMICAL USE SURVEY THIS JUNE

The USDA National Agriculture Statistics Service, in cooperation with Michigan State University Extension, will be conducting a survey of chemical use and IPM practices used in blueberries during the 2007 growing season. This survey will gather information that is essential for supporting the need for new registrations, section 18 labels, and for tracking pesticide use trends in this industry. This kind of information is used by EPA when making decisions related to blueberry, and it is also valuable to the MSU Blueberry Team when competing for funding to support research and extension projects. The survey will be conducted during June, and if your farm is selected a NASS representative will contact you to arrange a 30-45 minute interview. Gathering chemical application information can be made faster by having a photocopy or printout of the spray records from a representative field when the NASS representative visits. Please help represent your industry in this important effort.

MEETINGS AND ANNOUNCEMENTS

2008 Blueberry IPM Twilight Meeting Schedule:
All meetings held from 6-8PM
June 11: Cornerstone Ag, Van Buren County
June 24: Carini Farms, Ottawa County

These meetings are hosted by MSU to update growers on insect, disease, and weed control as the season progresses. They are completely free, with a light dinner served at 6PM. For more information, contact Paul Jenkins (517-432-7751, jenki132@msu.edu).

For more information visit our website at Blueberries.msu.edu

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Matt Grieshop, Organic Pest Management
Paul Jenkins, Small Fruit Education Coordinator
Mark Longstroth, Van Buren County Extension
Carlos Garcia, Ottawa County Extension
Bob Tritten, SE Michigan Extension

IN NEXT WEEK'S ISSUE…

Blueberry maggot
Post-bloom fruitworm management

This newsletter is produced by the MSU Blueberry Team with support from Project GREEEN, North Central IPM Center, MSU Extension and the EPA's Region 5 Strategic Ag. Initiative Program

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