Michigan Blueberry I.P.M. Update

May 22, 2007 Volume I, No. 6

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The Blueberry IPM Update is a weekly publication produced by Michigan State University Extension. To receive a copy of this newsletter, send an email to masonk@msu.edu.
Also available online through blueberries.msu.edu and at:
www.isaacslab.ent.msu.edu/blueberryscout/blueberryscout.htm

CROP STAGES

In Van Buren County, Jersey in Covert are at the beginning of petal fall. Blueray and Bluecrop are almost through petal fall in Grand Junction.
In Ottawa County, Blueray are at full bloom and Jersey are at 75% bloom in Holland. Rubel and Bluecrop are both at full bloom in West Olive.

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Jersey at 75% bloom in Holland

Editor's Note:
NEXT WEEK'S NEWSLETTER WILL BE DELAYED BY ONE DAY DUE TO THE MEMORIAL DAY HOLIDAY.

We hope you find the information in this newsletter useful in guiding what to look for as you scout your own farm. The scouting data shown in the Disease and Insect Updates below are taken from four Michigan blueberry farms. As conditions are different from farm to farm, we must stress that the information in this newsletter should not be used as a substitute for scouting your own fields. Your spray decisions should be made based on what is seen on your own farm.

Please use this newsletter to determine when and how to look for certain pests, identify potential pest problems, and to get information on the biology of pests and other aspects of integrated pest management. See the Insect and Disease Updates below for descriptions of some scouting methods that can be used on your farm. These scouting methods will also be demonstrated at the Blueberry IPM Scouting Workshops on June 13:

BLUEBERRY IPM SCOUTING WORKSHOP
June 13, 2007

10-12am at the Bodtke Farm, Grand Junction

3-5pm at Carini Farms, West Olive

DEGREE DAYS AND WEATHER NOTES

Weather Forecast: Temperatures will be in the upper 70's to mid 80's over the next few days. Chance of showers and thunderstorms Thursday and then cooler for the weekend. By 5-28 GDD_{50} will increase by ~100, and GDD_{42} will increase by ~150. Complete weather summaries and forecasts are at available enviroweather.msu.edu

GDD (from March 1)	Base 42	Base 50
	Van Buren County	
5-7	605	315
5-14	735	400
5-21	847	465
	Ottawa County	
5-7	479	232
5-14	628	328
5-21	736	387

FRUITWORM MANAGEMENT UPDATE

John Wise, Rufus Isaacs and Keith Mason
MSU Entomology

The warm weather that is expected for the middle of this week should push many varieties to petal fall, and at the same time fuel the development of cherry fruitworm (CFW) and cranberry fruitworm (CBFW). We expect the number of fruitworm moths caught to increase and we should see egglaying by cherry fruitworm in most areas of southwest Michigan. Egglaying by cranberry fruitworm probably will not occur during this time. If cranberry fruitworm and/or cherry fruitworm moths have been caught on your farm, or if you have had infestations of these pests in the past, you should be thinking about applying insecticides for fruitworm control when your bushes reach petal fall.

Pheromone traps should already be out in Michigan blueberry fields for monitoring of adult cherry fruitworm (CFW) and cranberry fruitworm (CBFW). CFW flight is well underway in most areas of SW Michigan and last week (Monday 14th) we received the first report of CFW larvae entering fruit in a Bluejay field. We have also trapped low numbers of CBFW moths in the past two weeks, in Van Buren, Allegan and Ottawa counties. Once a consistent number of moths of either species is caught in monitoring traps and blueberries reach the early fruit set stage (as some of the earliest varieties are now doing), these fields should be considered for protection against fruitworm larvae. Scouting for the presence of fruitworm eggs on fruit is best way of determining when control actions should begin.

Growers typically can manage both fruitworm pests together, but in recent years when there has been a cool period during blueberry bloom, the timing of CBFW and CFW have not overlapped. Instead, the earlier cherry fruitworm went unnoticed and the larvae were already inside fruit when CBFW control programs started. Monitoring for both insects in hotspots on the farm is a good idea, especially in early varieties where it is more likely that CFW infested fruit could be harvested.

There is an array of insecticides available for control of fruitworms, but their performance characteristics are not all the same, and only some of them can be used during bloom. It is important to refrain from using compounds that are toxic to pollinators when these insects are in your fields. Two products registered for use during bloom and/or in the presence of pollinators have provided consistent control of fruitworms in trials at the Trevor Nichols Research Complex and at grower fields. These are the *B.t.* products (such as Dipel® and Javelin®) and the insect growth regulator Confirm®. These products must be consumed by fruitworm larvae to be effective, so they are best applied over the top of fruitworm eggs so they are eaten as the larvae emerge. *B.t.* products have short residual activity, typically around five days, so are best applied when daily temperatures reach 70°F. Confirm is more resistant to breakdown, giving between seven and 14 days activity, and it is quite rainfast, which can be a useful property in Michigan spring weather. Another option for control of cranberry fruitworm is the growth regulator Esteem®. This insecticide disrupts the adult moth's ability to make eggs and disrupts hatching of eggs and molting of larvae. Because of its activity it is most effective when applied just before egg-laying, so timing is critical. When thinking about application timing during bloom, getting the most out of your insecticides will require close scouting of fields with high fruitworm pressure. As with all fruitworm control applications, excellent coverage of fruit clusters is required to ensure that eggs and/or larvae come in contact with the insecticide.

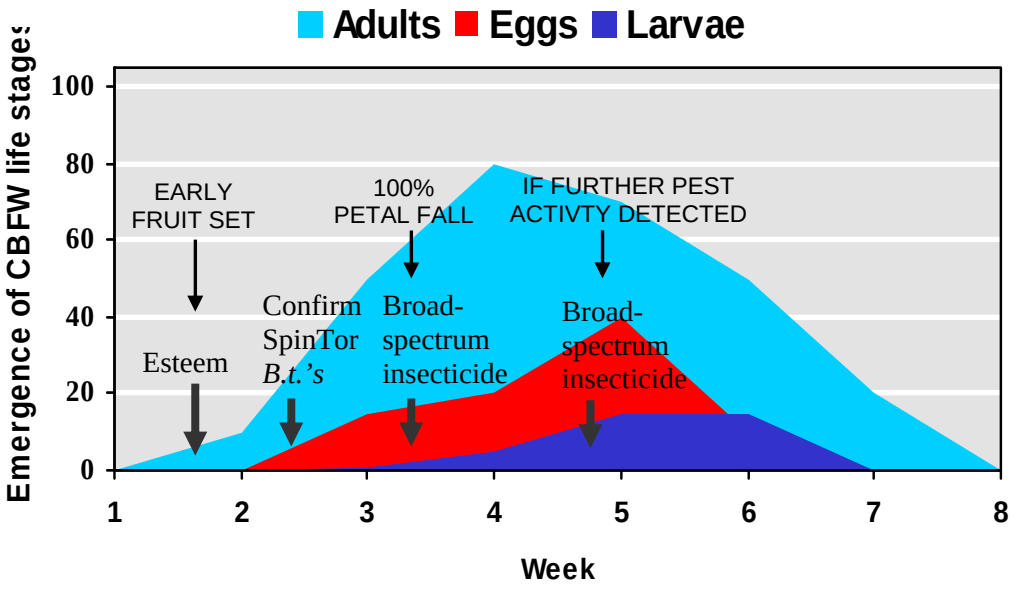
After 100% petal fall, the range of options for fruitworm control increases, with Guthion®, Imidan®, Asana®, Danitol®, Lannate® and Sevin® being the most effective of the broad-spectrum insecticides available. With all these products, maintaining good coverage is still important to get residue to the parts of the berry where fruitworms are found. Recent research trials in Michigan have demonstrated that Confirm® and SpinTor™ applied after petal fall to fields with low or moderate fruitworm pressure can also achieve control of fruitworms, with minimal negative impact on natural enemies such as parasitic wasps, ladybeetles and lacewings. Correct timing and coverage are critically important, so regular scouting of fields, use of sufficient spray volume to get good fruit coverage and selecting appropriate spreader-stickers can increase activity of most insecticides applied for fruitworm control.

The table and figure below are designed to summarize several key factors that can help you select an insecticide for your Integrated Pest Management program for fruitworm control in blueberries.

Details of insecticide options and timing for fruitworm control in blueberry

Compound Trade Name	Chemical Class	Life-stage Activity	Optimal Spray Timing	Pollinator/Parasitoid Toxicity rating *
Guthion/Imidan	Organophosphate	Eggs, Larvae, Adults	100% Petal Fall	H
Lannate/Sevin	Carbamate	Eggs, Larvae, Adults	100% Petal Fall	H
Asana/Danitol	Pyrethroid	Eggs, Larvae, Adults	100% Petal Fall	H
SpinTor/Entrust	Naturalyte	Eggs, Larvae	Early fruit set over/under eggs	M
Dipel	*B.t.*	Larvae	Early fruit set over eggs	S
Confirm	Growth regulator	Eggs, Larvae	Early fruit set over eggs	S
Esteem	Growth regulator	Eggs, Larvae	Early fruit set under eggs	S

* Pollinator/Parasitoid Toxicity rating; S – relatively safe, M – moderate toxicity, H – Highly Toxic.



PEST OF THE WEEK

Anthracnose fruit rot (Ripe Rot)
Colletotrichum acutatum (fungus)

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

Anthracnose fruit rot is the most common and widespread fruit rot disease of blueberries in Michigan and in the United States. The disease is caused by the fungus *Colletotrichum acutatum*. This fungus is responsible for substantial pre- and post-harvest losses in yield and fruit quality, including reduced shelf life and unappealing appearance of fruit. Pre-harvest crop losses may reach 10-20%, whereas post-harvest losses can be as high as 100% in severe cases. High levels of anthracnose fruit rot can also lead to unacceptable microbial counts in frozen processed fruit. Warm, wet seasons are particularly conducive to disease development.

Symptoms

Berries usually become infected while still green and immature. However, the infection remains latent and fruit rot symptoms do not appear until the berries ripen, hence the name "ripe rot". Berries show sunken areas and shriveling (Figs. 2a, 3a) and under humid conditions, support orange, gelatinous spore masses (Figs. 3a, b). After harvest, fruit can rot quickly (within 2-4 days) but rapid refrigeration delays rot development. In addition, *C. acutatum* sometimes causes blighting of blossoms and twigs which is difficult to distinguish from Phomopsis twig blight or Botrytis blossom blight. Cane cankers and leaf spots may also occur but are more sporadic.

Disease cycle

During spring, spores are released from dead twigs and buds during rainy periods and can initiate blossom blight and latent infections on green fruit. Once the spore lands on the fruit surface the fungus requires at least 12 hours of continuous wetness to initiate infection. The fungus will then proceed to colonize the tissue and sporulate on the fruit surface. Spores are spread by rain and irrigation water and can infect surrounding berries. Infections can also occur when healthy berries pick up spores from rotting berries or contaminated surfaces of harvesting and sorting equipment.

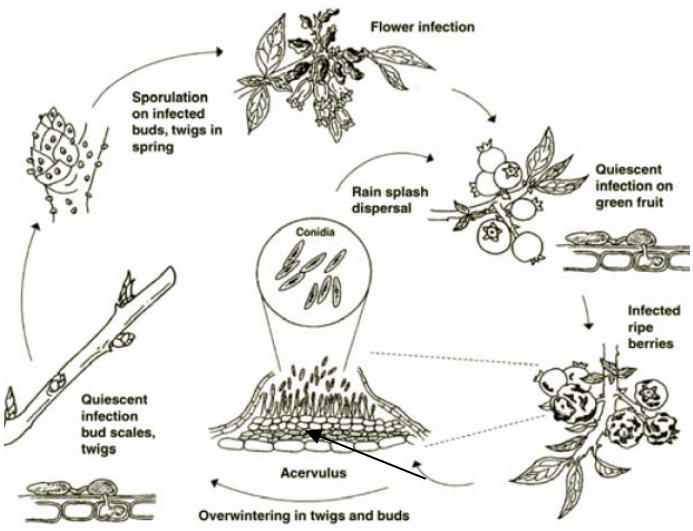


Figure 1. Disease cycle of *Colletotrichum acutatum* on blueberries. (from: Peres, N A. et al.. 2005. Plant Disease 89: 784-796.)

Figure 2. A) Field symptoms of anthracnose. B) Salmon-pink spore masses of *C. acutatum* on a twig.

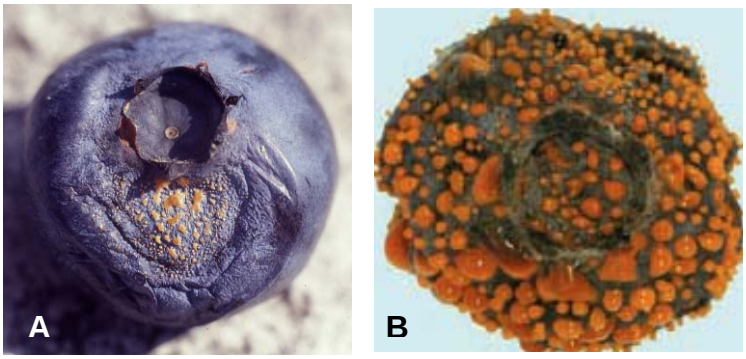


Figure 3. A) Late stage fruit rot symptoms seen in the field under high humidity. B) Post-harvest incubation of fruit under high humidity results in copious orange spore masses on the fruit surface.

Management

Since anthracnose does not manifest itself until close to harvest, preventative control strategies are necessary. This is especially important if the field has a history of anthracnose based on scouting or observations during harvest. Control measures should be aimed at making the environment less conducive for pathogen growth and development, e.g., by pruning bushes to create an open canopy (this will also allow better spray penetration), good weed control, and timing of overhead irrigation to allow rapid drying of leaves and fruit. Timely harvests and rapid cooling and processing of fruit can reduce post-harvest losses. A fungicide spray program from pink bud to harvest will prevent infection of blossoms and fruit. The E-154 extension bulletin lists several fungicides that are effective against anthracnose including Captan, Bravo, Pristine, Abound, Cabrio, and Switch. Bravo should not be used after bloom starts due to possible injury. In the long term, pruning out of old or infected canes and twigs can be effective at eradicating or reducing overwintering inoculum. Another option is to plant resistant cultivars, such as Elliott. Among the newer cultivars, Draper and Aurora are also resistant to anthracnose fruit rot. More research is needed to investigate whether bud infections in the fall are a significant source of inoculum for fruit infections the following year.

DISEASE UPDATE

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

Mummy Berry

This week all blueberry plots were at full bloom to petal fall. The number of shoot strikes per bush had increased somewhat compared to the previous week. Shoot strikes produce spores that are the main source of inoculum for fruit infection. Since bees are attracted to the shoot strikes by their UV pattern, they inadvertently transmit the spores while pollinating. Good pollinating weather will likely lead to more fruit infections. While open flowers remain, grower should consider fungicide treatments for control of fruit infection. As stated in previous issues, to scout for shoot strikes pick five bushes and record the number of shoot strike infections per bush. Shoot strikes can be identified by rapidly wilting leaves, a brown spreading pattern along the veins, and a gray powdery spore layer on the petiole and top of the leaf.

Farm	Date	Mummified berries per bush*	% germinated mummified berries	Mummy berry mushrooms per bush*	Mummy berry shoot strikes per bush	Blighted blossoms per bush **	Phomopsis twig blight per bush
Van Buren County							
Covert	5-7	0.7	29	0.2	0	-	0
	5-14	0.25	0	0	2.8	-	0.1
	5-21	-	-	-	3.4	1.2	0.4
Grand Junction	5-7	55	6	6	0	-	0
	5-14	36	0.3	0.1	29.1	-	0
	5-21	-	-	-	37.3	0.4	0.2
Ottawa County							
Holland	5-7	19	2.5	1	0	-	0
	5-14	12	3.4	0.8	7.2	-	0
	5-21	-	-	-	15.2	1.2	0.4
West Olive	5-7	7	6	0.6	0	-	0
	5-14	4.35	0	0	3.4	-	0
	5-21	-	-	-	17.7	1.0	0.4

* The numbers in this table are the average number of mummies in 18 sq ft area of soil at the base of each of 5 bushes spread out in a row. Mummy berry data was not collected after 5-21-07 because all apothecia had dried up.
** Blighted blossoms may be symptomatic of mummy berry, Phomopsis, Botrytis or anthracnose.

Blossom Blight – Phomopsis, Mummy berry, Botrytis, Anthracnose

Blighted blossoms were seen at low levels in all four scouted fields. In Michigan, four different pathogens can cause blossom blight. Just by looking at a blighted blossom it is often difficult to identify the causal agent unless fungal growth is visible. In many cases, the blighted blossoms looked like they were caused by Phomopsis, which can be identified by a brown discoloration of the twig that bears the flower cluster (Fig. 1, 2). Initially, the discoloration is ¼-½ inch long, but can expand to several inches long. In the case of mummy berry, a layer of gray powdery spores is restricted to the flower and/or cluster stem (Fig. 3). Botrytis blossom blight may occur after very wet and cool weather and is characterized by fluffy grayish brown spores all over the blossoms (Fig. 4). This is less likely considering the weather conditions we've had so far. Anthracnose blossom blight does not have very diagnostic features and looks like Phomopsis twig blight. Incubation in the laboratory is necessary to identify the causal agent. Blossoms were collected for further diagnosis and the causal fungi will be listed in next week's scouting update.

To scout for blighted blossoms pick 5 bushes and record the number of blighted blossoms per bush. Inspect blossoms for fungal sporulation or other identifying characteristics.

Fig. 1. Blueberry flower cluster killed by Phomopsis twig blight. Note brown discoloration of subtending twig (arrow).

Fig. 2. Brown, spreading lesion on stem is typical of Phomopsis twig blight (arrow). (Photo by Phillip Wharton, MSU)

Fig. 3. Flower cluster killed by the mummy berry fungus (*Monilinia vaccinii-corymbosi*) with characteristic layer of gray powdery spores on cluster stem and flower stem (arrow). (Photo by Peter Oudemans, Rutgers University).

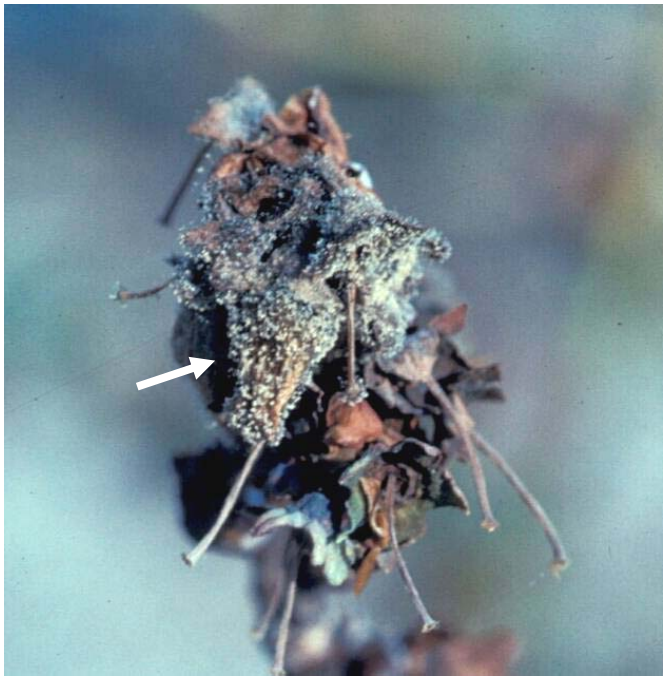


Fig. 4. Flower cluster killed by *Botrytis cinerea* showing layer of grayish brown powdery spores all over blossoms and cluster (arrow). (Photo by Bill Cline, NC State University).

INSECT UPDATE

FRUITWORMS

In general insect activity was low over much of last week due to cool weather. Low numbers of cranberry fruitworm and cherry fruitworm moths were caught in Van Buren and Ottawa counties. Farms in Van Buren county were scouted for cherry and cranberry fruitworm eggs and damage, but no eggs or damaged berries were detected. In the next week, we expect cherry fruitworm and cranberry fruitworm captures to increase, and we expect the first cherry fruitworm eggs to be seen in Van Buren and Ottawa counties. During the period when bees are still present in fields, control of fruitworms can be achieved using Confirm or B.t.
Click here for more info and photos of cranberry and cherry fruitworm.

LEAFROLLERS

An obliquebanded leafroller larva was observed at the Covert farm. Continue to scout your bushes for these larvae and their damage and Click here for more information on Obliquebanded leafroller. Specific insecticide treatment for this pest is usually not required as insecticide sprays targeting fruitworms are usually effective at controlling early season leafrollers.

BLUEBERRY TIP BORER/BLUEBERRY GALL MIDGE

This pest was detected at the Covert farm. Click here for more information about blueberry tip borer.

MONITORING FOR FRUITWORMS

To monitor for Cranberry fruitworm (CBFW) and Cherry fruitworm (CFW) use pheromone baited traps. For each species, use one Large Plastic Delta Trap (LPD) w/ the appropriate sex pheromone lure pinned to the inside of the roof of the trap. Attach the trap to the outer canopy of the upper third of a blueberry bush on the field border. Traps should be hung adjacent to woods in "hot spots" where damage has been noted in the past. Set traps at least 30ft apart in mid to late April. Check traps weekly, record the number of moths caught. Remove moths from the sticky trap insert and replace sticky insert as needed. Traps are available from Great Lakes IPM **http://www.greatlakesipm.com/.**

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, larvae 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. See the article below for pictures and more info.

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 on blueberry aphids, **follow this link to the aphid section on the blueberry facts website.**

Van Buren County						
Farm	Date	CBFW moths per trap	CFW moths per trap	Blueberry aphid % infested shoots	Blueberry maggot per trap	Japanese beetle per 20 bushes
Covert	5-7	0	2	0		
	5-14	0	10	0		
	5-21	1	2	0		
Grand Junction	5-7	0	0	0		
	5-14	1	0	0		
	5-21	1	0	0		
Ottawa County						
Holland	5-7	0	0	0		
	5-14	0	0	0		
	5-21	0	0	0		
West Olive	5-7	0	0	0		
	5-14	0	8	0		
	5-21	0		0		

UPCOMING MEETING

June 13 - Blueberry Scouting and IPM Demonstration Workshops
10-12am at Bodtke Farm, Van Buren County
3-5pm at Carini Farms, Ottawa County

MSU BLUEBERRY TEAM

Horticulture - Eric Hanson
Plant Pathology - Annemiek Schilder
Entomology - Rufus Isaacs
Trevor Nichols Research Station - John Wise
Van Buren Co. - Mark Longstroth
Ottawa Co. – Carlos Garcia
Berrien Co. - Greg Vlaming
Southeast Michigan – Bob Tritten

For more information, see our website at blueberries.msu.edu

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