M I C H I G A N

Blueberry Newsletter

A newsletter from Michigan State University for the Michigan blueberry industry

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MICHIGAN STATE UNIVERSITY

News you can use

Disease management. Mummified berries and anthracnose fruit rot symptoms are now apparent in blueberry fields. Record disease levels to evaluate your disease control program. Continue control of fruit rots through harvest. Scout for leaf rust in fields that have had a problem in past years; symptoms tend to be most severe in the vicinity of hemlock trees.

Insect management. Fruitworm traps should be removed for harvest. Japanese beetle and blueberry maggot are still active.

Crop development. In Van Buren County, Jersey in Covert is about 5-7 days from first harvest, and Bluecrop and Blueray in Grand Junction are in the middle of second harvest. In Ottawa County, Blueray in Holland, and Rubel in West Olive is ready for first harvest. Bluecrop in West Olive is ready for second harvest.

Japanese beetle biocontrol. See article on Page 2 and information about the meeting on Page 6 to learn how you can help control this pest naturally.

Jersey almost ready for 1st harvest in Covert

Blueray ready for harvest in Holland

GROWING DEGREE DAYS — From March 1

	2010		Last Year	
	Base 42	Base 50	Base 42	Base 50
Grand Junction, MI				
7/12	2389	1578	1985	1249
7/19	2634	1767	2149	1357
Projected for 7/26	2867	1944	2339	1491
West Olive, MI				
7/12	2177	1393	1793	1093
7/19	2406	1566	1946	1190
Projected for 7/26	2645	1749	2125	1314

See http://enviroweather.msu.edu for more information.

SW Michigan

Blueberry harvest continues with all growers picking Bluecrop across the region. Jersey harvest will begin this week. Blueberry maggot flies are the primary insect pest now. Contact insecticides are a good fit to kill fruit fly adults and other insects of concern. Anthracnose fruit rot can be found in ripe fruit. Anthracnose can infect sound fruit. Blueberry cane collapse from phomopsis seems to have ended. Collapse due to flooding in May and June is also apparent in some fields. Growers need to irrigate as the plants are using about a quarter inch of water a day. Recent hot conditions and the demand for lots of water are more that the small root system of blueberries can supply.

Mark Longstroth
MSU Extension, Southwest

Opportunity to kick-start biocontrol of Japanese beetle

Japanese beetle is a pest in vineyards across southern Michigan, with some new hot-spots appearing in parts of northern Michigan. This pest has established across the eastern United States in part because of low levels of biological control, and surveys in Michigan have found very limited natural control of this pest. One way to increase biocontrol in your own farm, and thereby provide long-term suppression this pest, is to introduce a biocontrol agent. MSU's Turf Entomology Program is providing an opportunity to bring grubs from a site infected with a stomach parasite of Japanese beetle, to seed your own land. Details are on Page 6.

Biological control of Japanese beetle in Michigan

Introduction. Japanese beetle (*Popillia japonica* Newman) is one of the most destructive pests of golf courses, sod farms, grapes, blueberries, and nursery crops in Michigan. Turf managers, fruit and nursery growers frequently use insecticides to minimize beetle damage. Around the home, Japanese beetles feed heavily on lindens, sycamores, Japanese maple, birch, chestnut, sassafras, hibiscus, crabapple, ornamental cherries, roses, mountain ash, Virginia creeper and on the flowers of many other plants (Johnson & Lyon 1988). In heavily infested areas, insecticides must be applied several times in July and August to maintain foliage on these plants.

Long-term studies of Japanese beetle populations in the eastern United States suggest the highest populations and most severe damage occurs during a 10 to 30-year period after initial establishment. Populations may then decrease and begin to fluctuate, usually at lower levels. The cause of this population reduction over a 30-year period is not known, but several parasites and pathogens are suspected of playing a role.

MSU Research. When we surveyed Japanese beetle and its natural enemies at over 50 locations in southern Michigan in 1999 and 2000 we discovered that an important natural enemy, known to be widespread in Connecticut, was absent in Michigan. This missing pathogen is called *Ovavesicula*, a protozoan that is only known to infect Japanese beetle and no other insect or animal. We successfully introduced *Ovavesicula* to 3 locations in Michigan in 2001 by collecting live infected grubs from Connecticut releasing them into research plots at 3 golf courses. The research was initially supported by the Michigan Turfgrass Foundation and Project GREEEN. Later, the Michigan Department of Agriculture and over 50 individual homeowners contributed to the project.

Six years after *Ovavesicula* was introduced more than 35% of the grubs were found to be infected on any sample date, and the pathogen had spread to other parts of the golf courses. Our research document a 55% reduction in Japanese grubs from October to April where *Ovavesicula* is active. In addition, 5 – 25% of the adults become infected and infected females do not produce as many eggs. The combined impact of grub mortality and reduced egg production gives an average population reduction of 64% per year due to *Ovavesicula*. Actual population reduction due to *Ovavesicula* may be even higher. This level of sustained natural biological appears to have reduced populations of Japanese beetle in the Kalamazoo and Battle Creek area to the point where very little feeding damage is now found on linden trees or to turfgrass in fairways at our study sites.

In summary, the natural spread of *Ovavesicula* can be enhanced by collecting infected beetles from one of the sites in Michigan where it is established and releasing them at new locations. It is estimated that it will take 5 – 10 years after infected beetles are introduce before *Ovavesicula* has a significant impact on the local population of Japanese beetle. However, once *Ovavesicula* is established it will be with us forever. This pathogen cannot be purchased and it is only known to infect Japanese beetle (no risk to other insects or animals).

2010 Biocontrol Field Day. See calendar on Page 6 for details on how you can participate.

Dave Smitley & Rufus Isaacs
MSU Department of Entomology

Disease update

This week fruit in all scouted plots continued to ripen. The amount of new mummy berry-infected fruit increased significantly this week, probably due to the fact that it is easier to see the more advanced symptoms of the disease (a white, dry, ridged fruit epidermis, and a thick black wall inside fruits when cut transversely) (Figures 1 and 2). The West Olive site had the highest average incidence with 96.7 mummified berries per bush (Figure 3). Furthermore, fruit rots were seen in the field for the first time in three out of four sites. Fruit rots generally increase with each harvest so now is an important time to scout for fruit rots as they can occur in the field and post harvest.

Table 1. Disease scouting results

Farm	Date	Avg number of newly mummified fruits per bush*	Avg number of infected anthracnose clusters per bush*	Avg number of infected Alternaria clusters per bush*
		VAN BUREN COUNTY		
Covert	6/28	not present	0.0	0.0
	7/19	0.7	0.0	0.0
Grand Junction	6/28	1.2	0.0	0.0
	7/19	23.5	0.1	0.0
		OTTAWA COUNTY		
Holland	6/28	not present	0.0	0.0
	7/19	0.9	0.3	0.0
West Olive	6/28	2.8	0.0	0.0
	7/19	96.7	1.1	0.0

*Average of 10 bushes.

Fig 1. The fruit epidermis of newly mummified berries has mostly dried, making them easy to see this time of year, 19 July; *Photo: T. Miles.*

Fig 2. Cross-section of mummy berry-infected fruit seen on 19 July; *Photo: T. Miles.*

Fig 3. Newly infected mummy berries falling on the ground, seen on 19 July; *Photo: T. Miles.*

Fig 4. Anthracnose fruit rot symptoms observed on 19 July; *Photo: T. Miles.*

Anthracnose and Alternaria Fruit Rot. Anthracnose (orange gel-like spore masses; caused by *Colletotrichum acutatum*) and Alternaria (dark-green powdery spore masses; caused by *Alternaria* spp.) are the main post harvest diseases of blueberries in Michigan. Anthracnose in particular is favored by hot, humid weather. Fruit rots can cause significant pre- and post-harvest yield losses. Berries with high fruit rot levels also tend to have higher microbial counts. Healthy berries can get infected by *Colletotrichum* spores washing down from infected berries in clusters during rain events or overhead irrigation (Figure 4). Infections can even occur by infected berries or spores touching healthy berries on the harvester or sorting line. At this time, *Alternaria* spores are also ubiquitous in the air of blueberry fields. Pre-harvest Alternaria rot typically affects the calyx end of the blueberry (Figure 5), but post-harvest Alternaria infections spread mostly from the scar, which provides moisture for infection (Figure 6). Ripe berries are very susceptible to both anthracnose and Alternaria fruit rot. Botrytis fruit rot caused by *Botrytis cinerea* is also common in wet years but usually is not visible in the field before harvest. Before harvest, fruit rots can be controlled by proper timing of fungicide treatments and reducing the frequency of overhead irrigation. While fungicides cannot cure already infected berries,

spraying Abound, Cabrio, Switch or Pristine at this time (even between harvests) can reduce the number of secondary infections and the incidence of post-harvest rot for later harvests. Scouting for fruit rots in the field at this time can give an indication whether fungicide sprays are needed.

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

Fig 5. Alternaria fruit rot symptoms with sporulation occurring around the calyx cup, typical of pre-harvest Alternaria rot, observed on 19 July; *Photo: T. Miles.*

Fig 6. Post-harvest Alternaria fruit rot symptoms where the infection originated at the fruit scar after harvest; *Photo: T. Miles.*

Beware of blueberry leaf rust

Be on the lookout for blueberry leaf rust, particularly in fields that have had a problem in previous years. While this disease is relatively rare in Michigan, it can be severe in fields that are affected. Rainy periods in the middle of the growing season are conducive to disease development. It also occasionally pops up on blueberry plants in greenhouses. Leaf rust is caused by the fungus *Pucciniastrum vaccinii.* Yellow spots appear on leaves by mid season and eventually turn reddish brown (Fig. 7). On the lower leaf surface, yellow to orange spore pustules (uredia) are present which may turn rusty red with age (Fig. 8). You have to turn the leaf over to see the orange pustules. The disease is not systemic in blueberries. Leaf rust can rapidly increase towards the end of the season. It generally has little impact on yield, but may cause premature defoliation. It is possible that severe defoliation could affect winterhardiness of the canes.

The alternate host of the rust fungus is hemlock (*Tsuga* spp.), which explains why the rust is more severe in the vicinity of hemlock trees (up to 0.6 km). Airborne aeciospores from hemlock needles infect blueberry leaves in early summer. Yellow uredospores (Fig. 8) then develop on blueberry leaves and spread the disease among blueberries. The uredospores are airborne and spread easily from leaf to leaf and bush to bush. In fall, teliospores (the overwintering stage) form in the rust pustules on blueberry leaves. The teliospores produce basidiospores which are airborne and infect hemlock needles in early spring. In areas where green leaves are present all year (in the southern US or in greenhouses), hemlock trees are not needed. On green leaves, the fungus will continue to perpetuate itself via the orange/yellow uredospores.

Fig 7. Leaf rust symptoms on upper leaf surface consist of reddish-brown leaf spots; *Photo: A. Schilder.*

Fig 8. On the lower leaf surface, orange-yellow pustules are visible; *Photo: B. Cline.*

For management, a recommendation to remove hemlock trees within ½ mile may neither be desirable or practical. However, it would remove the alternative host, which would break the life cycle in cold climates. Raking up blueberry leaves after leaf fall and burning them can also help to reduce inoculum carry over. Other things that can be done: limit overhead irrigation to reduce leaf wetness and apply effective fungicides during periods of high risk (usually starting before or shortly after harvest). Though we have not evaluated any fungicides for rust control in blueberries in Michigan, the sterol inhibitors are usually quite effective against rust fungi, and both Indar (30-day PHI) and Orbit (30-day PHI) are labeled for rust control. Bravo also lists rust on the label – just remember the PHI is 42 days and sprays are not recommended after full bloom due to potential phytotoxicity. However, all of these fungicides can be sprayed after harvest provided that the maximum number of sprays per season is not exceeded. Sonata (*Bacillus pumilis*), a biofungicide is also labeled for blueberry rust control and has a 0-day PHI. Adding NuFilm as a spreader-sticker improves activity of Sonata. Abound does not have rust listed on its label and the labels of Pristine and Cabrio list "suppression" of rusts only, which indicates that they are only moderate effective against rust.

Annemiek Schilder
Department of Plant Pathology
Michigan State University

Insect update

Cranberry fruitworm moth flight is over for the season at all the farms we scouted. Growers and scouts should remove cranberry fruitworm (and cherry fruitworm) traps from fields in preparation for harvest. As harvest has begun in many varieties over a large area, there is no need to scout for fruitworm eggs and damage. At harvest, fruitworm damage levels were well below 1% of berries damaged in the fields we monitor. Growers and scouts should make note of the level and location of fruitworm damage to help assess control in the field as well as identify hotspots to keep in mind for planning for next season.

Fig 9. Blueberry maggot flies were captured in Van Buren and Ottawa Counties. Note the distinguishing 'W' shaped marking on the wings; *Photo: K. Mason.*

Over the past two weeks, low numbers of small aphid colonies (1 to 3 individuals per shoot) were seen at all the scouted farms. Parasitized aphids were observed at the West Olive, Covert and Grand Junction farms. Continue to check bushes for aphid colonies, particularly on farms where there are varieties that are susceptible to shoestring virus.

Blueberry maggot flies were caught at the Covert and Holland farms. Growers and scouts should continue to check traps at least once per week (twice per week, if possible) through harvest. Traps should be temporarily removed from fields during mechanical harvesting, but remember to hang the traps again after the picker finishes. For more information about monitoring for this pest, see the blueberries.msu.edu website or the June 8, 2010 edition of the Michigan Blueberry Newsletter.

Japanese beetles were present on all the farms we monitored, but we found fairly low numbers of beetles overall with a few hotspots (greater than one beetle per bush on average). Light Japanese beetle feeding damage was observed on leaves and fruit at all monitored farms, but it appears there is more fruit feeding by birds than by beetles at this time. Fields should be monitored weekly for the presence of Japanese beetles from now through harvest by examining 10 bushes on the field border and 10 bushes in the field interior and recording the number of beetles on each bush. Keep in mind Japanese beetles are normally more common adjacent to grassy areas on sandy soils, and in areas where soils remain moist in July and August. Regular monitoring will aid growers and scouts in timing control measures to keep fields clean of Japanese beetles before harvest, and reduce the possibility of contamination during picking. Read more about Japanese beetle at the blueberries.msu.edu website.

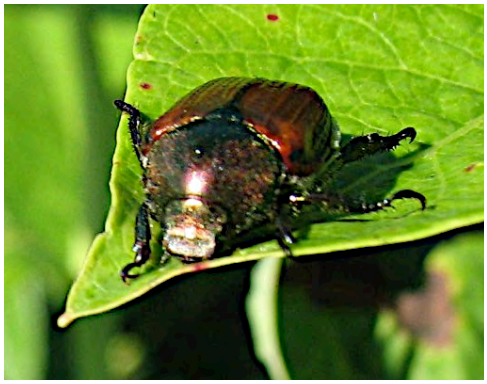

Fig 10. Japanese beetle observed at the Covert farm; *Photo: K. Mason.*

Lecanium scale crawler emergence continues to decline, so fields that need to be treated for this pest should be treated soon before crawlers settle down and begin to form the waxy covering. See the longer article in the July 7th edition of the newsletter.

Tussock moth larvae, which can be a pest during harvest was not seen at any of the farms we scouted. Growers and scouts should keep an eye out for this sporadic pest. See the Blueberry Facts website for more information on this insect.

Keith Mason & Rufus Isaacs
Department of Entomology
Michigan State University

Table 2. 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	7/12	0	0	5	0	3
	7/19	0	0	5	1	4
Grand Junction	7/12	0	0	10	0	3
	7/19	0	0	5	0	1
			OTTAWA COUNTY			
Holland	7/12	0	0	10	0	5
	7/19	0	0	5	1	15
West Olive	7/12	0	1	10	0	0
	7/19	0	1	5	0	2

2010-11 Grower Events

JULY 28, 2010 10AM-12PM
2010 Japanese beetle biocontrol field day
We have organized a biocontrol field day for Wednesday, July 28, 2010 at the Michigan State University Tollgate Research and Extension Center in Novi, Michigan. At 10:00, 10:30 and 11:00 AM we will give brief presentations on the Japanese beetle biocontrol program, including instructions on how to transport and release infected beetles. Following each presentation participants will be given a small zip-lock sandwich bag containing infected live Japanese beetles. You are welcome to take them and release them anywhere in Michigan, but Japanese beetle cannot be transported out of the State of Michigan unless you have a permit from USDA-APHIS.

SEPTEMBER 28, 2010 1-4PM
Trevor Nichols Research Complex Field Day
Location: Trevor Nichols Research Complex, Fennville
Education program information: John Wise, 269-330-2403
Website: http://www.maes.msu.edu/tnrc/calendar.htm

The field day will focus on insect and disease research and efficacy trials that were carried out this season by Larry Gut, Rufus Isaacs, Annemiek Schilder, George Sundin, Mark Whalon and John Wise.

OCTOBER 12-15, 2010
NABC-USHBC Fall Meeting
Location: Amway Grand Plaza Hotel, Grand Rapids

OCTOBER 12-13, 2010
National Blueberry Exposition - ***runs concurrent with the NABC-USHBC fall meetings***
Location: Amway Grand Plaza Hotel & DeVos Place Conv. Center
Contact expo@blueberries.com for more information.

DECEMBER 7-9, 2010
Great Lakes Fruit, Vegetable, and Farm Market Expo
Blueberry sessions: Wed, Dec. 8, morning and afternoon
Location: DeVos Place Convention Center, Grand Rapids
Education program information: Eric Hanson, 517-355-5191, x1386
Website: http://www.glexpo.com/index.php

FEBRUARY 9-10, 2011 ***(Tentative)***
Southwest Hort Days
Location: Lake Michigan College, Benton Harbor
Education program information: Mark Longstroth, 269-330-2790
Website: http://www.canr.msu.edu/vanburen/swhort.htm

MICHIGAN STATE UNIVERSITY EXTENSION

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