Michigan Blueberry I.P.M. Update

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Contents

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 10% bloom. Blueray are at trace bloom and Bluecrop are approaching 25% bloom in Grand Junction.

In Ottawa County, Blueray are at trace bloom and Jersey are at late pink bud in Holland. Rubel and Bluecrop are both at late pink bud in West Olive.

Bluecrop at 25% bloom in Grand Junction

DEGREE DAYS AND WEATHER NOTES

Weather Forecast: Warm temperatures will continue this week. Chance of showers and thunderstorms Tuesday through Thursday. By 5-14 GDD_{50} will increase by ~75, and GDD_{42} will increase by ~130. Complete weather summaries and forecasts are at available enviroweather.msu.edu

GDD (from March 1)	Base 42	Base 50
	Van Buren County	
4-23	382	189
4-30	474	237
5-7	602	311
	Ottawa County	
4-23	295	137
4-30	368	170
5-7	476	229

Editor's Note: 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
10-12am at the Bodtke Farm, Grand Junction
3-5pm at Carini Farms, West Olive

Gibberellin to enhance blueberry fruitset

Eric Hanson, MSU Horticulture

This article originally appeared in the MSU Fruit CAT ALERT newsletter on May 1, 2007.
Click here to check out the Fruit Cat Alert newsletters.

Compared to most fruit crops, a high percentage of blueberry flowers normally produce fruit. When bees are numerous and weather is warm and calm, 80-95 % of flowers may set fruit. However, cold, rainy weather during bloom restricts honey bee activity and pollination, resulting in lower fruit set and often reduced berry size. Flowers that are not pollinated within 3-5 days after opening are unlikely to set fruit. After normal pollination, berry growth is dependent on the production of gibberellin and perhaps other growth promoters in the ovary tissues and viable seeds. If flowers are not pollinated, they abort. If only a few ovules are fertilized, the fruit may set, but not contain enough seeds to grow to full size.

When pollination is limited by poor weather, gibberellin (GA) sometimes improves % set and berry size. Several GA products (ProGibb, GibGro) are labeled for highbush blueberries. GA may result in retention of some seedless (parthenocarpic) fruit that normally drop, and increases the size of berries with low seed numbers. GA can be applied in a single spray during bloom (80 gram active ingredient per acre) or two 40 g sprays, one

during bloom and the second 10-14 days later. Higher spray volumes (40 to 100 gallons per acre) may improve coverage and effects. Slow-drying conditions also increase absorption. Also make sure your spray water pH is not above 7.5.

Since the cost of 80 g of GA is over $100, it is important to know when to use GA. If weather has been reasonable good for bee activity and the white corollas fall easily from the bushes, pollination is probably adequate. Keep in mind that blueberries can bloom over a long time, and often only a few days on good conditions is enough to provide adequate pollination. Consistently cold, rainy and/or windy weather through bloom causes pollination problems. If the corollas stay on the bushes longer than usual and turn red/purple before eventually dropping, pollination may have been inadequate. The corollas of pollinated flowers drop readily while still white. Varieties with fruit set problems (Jersey, Coville, Earliblue, Berkeley, Blueray) are most likely to benefit from GA. Jersey, for example, is relatively unattractive to honeybees, and berry numbers and size are often limited by inadequate pollination. GA does not always provide a benefit, and effects can be subtle. A key to learning about GA benefits is to leave non-treated check rows. This is the only way to tell if your money was well spent.

2006 Trial. Because weather during bloom was poor, we treated Jersey bushes at the Southwest Michigan Research and Extension Center with ProGibb applied twice at 40 g a.i./acre (17, 27 May) or applied once (17 May) to a single application of 80 g/acre on. On 17 May, 30% of Jersey petals had fallen. Treatments were applied in 50 gallons spray per acre.

Results were fairly typical for years when there is a response to ProGibb. The 80 g rate applied once increased yield by about 30% over control plots, and there was a trend towards a response from the 40 g treatment as well (Table 1). The higher yield appeared to result from more berries rather than an increase in average berry weight. During the week prior to the first ProGibb spray, measurable rain occurred every day, and maximum daily temperature exceeded 60oF only on one day. These are the type of conditions when growers are likely to see benefits from ProGibb.

Table 3. Effect of ProGibb applications of average berry weight and yield of 'Jersey' blueberries, SWMREC, 2006.

Treatment	Average berry weight (g)		Yield (lb/bush)		
	1st pick	2nd pick	1st pick	2nd pick	Total
Control	1.22 a	0.78 a	4.1 a	0.9 a	5.0 a
ProGibb 40 g twice	1.18 a	0.82 a	5.0 a	1.1 a	6.1 ab
ProGibb 80 g once	1.27 a	0.85 a	5.0 a	1.5 b	6.5 b

PEST OF THE WEEK – Blueberry aphid

Rufus Isaacs, MSU Entomology

With the rapid growth of leaf clusters in the last week, it is time to begin scouting for aphids in your fields. Several species of aphids colonize blueberry bushes. The most damaging species transmit viruses that cause poor plant growth and reduced yield. Blueberry aphid (*Illinoia pepperi*) is the vector of blueberry shoestring virus and blueberry scorch, which is also transmitted by *Ericaphis* species aphids. (See the disease section of the MSU Blueberry Facts website for symptoms of these viral diseases.) Early detection and control of aphids can help slow the spread of these diseases in susceptible varieties.

Aphids overwinter as tiny eggs on blueberry bushes. In spring, young aphids hatch and colonize new leaf growth, living on the undersides of leaves. Populations grow during the summer and can cause sooty mold on fruit if populations are very high. Parasitic wasps and other natural enemies feed on aphids, suppressing their abundance. Scout for aphids on the undersides of leaves, focusing on young shoots at the bases of bushes.

Aphid colony on underside of leaf.
Jerry A. Payne, USDA ARS


Adult blueberry aphid.


Parasitized aphid (mummy)

DISEASE UPDATE

Infection risk for mummy berry will continue through this week especially with rain in the forecast; however the number of mushrooms and the overall appearance and health of the mushrooms are declining (see Fig. 2). Mummy berry mushrooms don't live very long at higher temperatures especially if the soil is dry (e.g., less than a week at 70°F, but 2-3 weeks at 50°F and up to 4 weeks at 40°F). However, at high temperatures, mushrooms expand faster and release more ascospores per day. While shoot strikes were not yet found in the scouted plots, they have been reported in other fields. It takes about 2 weeks for the symptoms to appear after infection. Growers should therefore consider fungicide treatments if mummies with mushrooms and/or shoot strikes are found. If open flowers are present, this is even more important, since the flowers become infected by spores produced on the shoot strikes (Fig. 3). When bees are actively pollinating, they inadvertently pick up spores from the shoot strikes and deliver them to the flowers.

Van Buren County						
Farm	Date	Mummified berries per bush*	% germinated mummified berries	Mummy berry mushrooms per bush*	Phomopsis canker	Botrytis
Covert	4-23	0.1	0	0		
	4-30	0.4	12	0.05		
	5-7	0.7	29	0.2		
Grand Junction	4-23	21	26	9		
	4-30	29	17	12		
	5-7	55	6	6		
Ottawa County						
Holland	4-23	10	29	4		
	4-30	11	14	3		
	5-7	19	2.5	1		
West Olive	4-23	5	24	1		
	4-30	3	33	2		
	5-7	7	6	0.6		

* The numbers in this table are the average number of mummies in 9 sq ft area of soil at the base of each of 5 bushes spread out in a row.

To scout for mummy berry in fields with susceptible varieties, visually examine an approximately 9 sq ft area of soil at the base of each of five bushes spread out in a row, preferably a mummy berry hot spot. Count the number of mummified berries and mushrooms (Fig. 1). To scout for shoot strikes (Fig. 4a, b), pick five bushes and record the number of shoot strike infections per bush. Flower strikes (Fig. 4 c) can also occur, but are generally less common than shoot strikes. Both shoot and flower strikes are characterized by drooping/wilting symptoms and a layer of gray spores on the surface. These spores are spread by insects, wind and rain. Bees are attracted to the shoot and flower strikes due to their UV light pattern (a nifty trick of the pathogen) and pick up the spores on their legs and bodies. Bees then inadvertently deliver these spores to the flowers where infection takes place through the stigma. Flowers are susceptible for about 4 days after they open. The more shoot strikes there are and the better the weather for pollination, the greater the risk of flower and fruit infection.

Fig. 1. Healthy mummy berry mushrooms.

Fig. 2. Mummy mushrooms that are declining and drying up (courtesy of Peter Oudemans, Rutgers University).

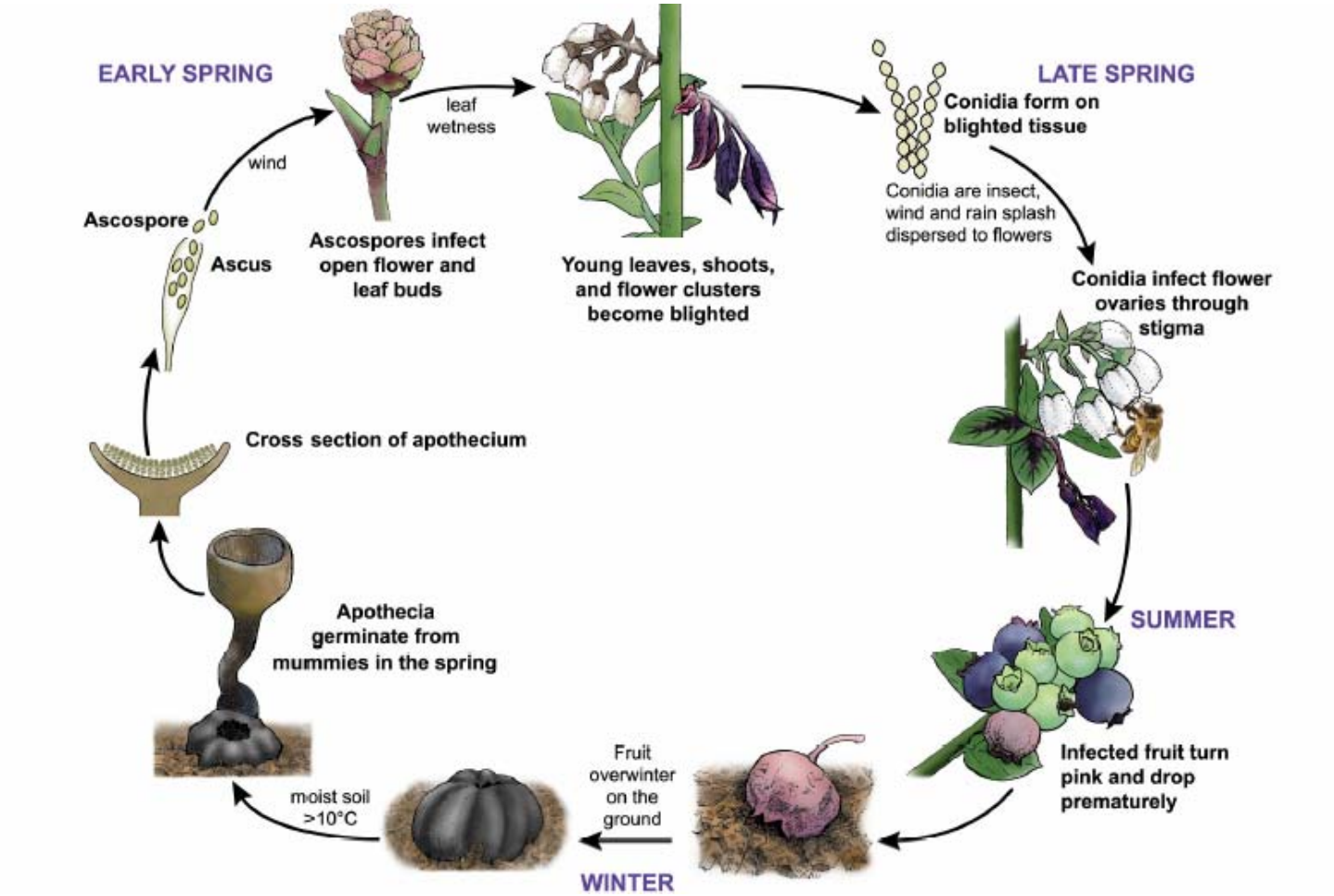

Fig. 3. Disease cycle of mummy berry of blueberry (drawn by Marlene Cameron).

Fig. 4. a. Early shoot strike symptoms, b. Advanced shoot strike symptoms with gray sporulation clearly visible, c. Flower strike with gray sporulation on flower stems (photo of flower strike courtesy of Peter Oudemans, Rutgers University).

INSECT UPDATE

FRUITWORMS

The first cherry fruitworm were caught in Covert, and moths were caught at an Ottawa county farm not involved in this project. Cranberry fruitworm have not been caught. Traps for these moths should already be set and checked weekly until harvest. The "contaminant" moth, *Pseudexentra vaccinii* is still being caught in CFW traps, but the numbers are much lower than in recent weeks. See BB IPM Update from April 24th for more info about this moth. In the next week, we expect Cherry fruitworm captures to increase. If the current warm weather continues, we expect to see emergence of cranberry fruitworm in Van Buren County in the next 7 to 10 days.

LEAFROLLERS

Leafroller feeding damage was observed at the Covert and West Olive farms. 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.

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 info on blueberry aphids, see the Pest of the Week section above.

Scouting methods for other insects will be included when it is time to look for those pests.

Farm	Date	CBFW moths per trap	CFW moths per trap	Blueberry aphid % infested shoots	Blueberry maggot per trap	Japanese beetle per 20 bushes
Van Buren County						
Covert	4-23	0	0	-		
	4-30	0	0	-		
	5-7	0	2	0		
Grand Junction	4-23	0	0	-		
	4-30	0	0	-		
	5-7	0	0	0		
Ottawa County						
Holland	4-23	0	0	-		
	4-30	0	0	-		
	5-7	0	0	0		
West Olive	4-23	0	0	-		
	4-30	0	0	-		
	5-7	0	0	0		

FRUITWORM MONITORING AND CONTROL

John C. Wise, Ryan VanderPoppen & Rufus Isaacs
Department of Entomology, Michigan State University

Introduction

Cranberry Fruitworm (*Acrobasis vaccinii*) and Cherry Fruitworm (*Grapholita packardi*) are the most significant Lepidopteran pests directly attacking the fruit of blueberries in commercial fields in Michigan. Both pests have similar life histories, which makes it possible to address them together in one fact-sheet. Both Cranberry Fruitworm (CBFW) and Cherry Fruitworm (CFW) are native to North America, as are the blueberries they infest. Without decisive management one or both of these pests can cause significant economic injury to the blueberry crop. This fact-sheet will discuss general life stages of CBFW and CFW, as well as Integrated Pest Management strategies for managing these pests in blueberries.

Hosts

Cranberry fruitworm can be found on blueberry, cranberry, and huckleberry where they feed on fruit. Hosts of cherry fruitworm include apple, plum, cherry, rose, blueberry, hawthorn, and peach. Larvae feed in fruit or growing shoots.

Identification

Adults of CFW are grayish black and 5 to 6 mm in length. CBFW adults are about 11 mm in length, with grayish brown forewings that each have two distinctive whitish triangles (Figures 1-2).

Figures 1-2. Adults of CFW (top) and CBFW (bottom).

Eggs of CFW are flat, with a round to oval shape, and they appear opaque (Figure 3-5). Upon maturity, the dark head capsule of the developing larva is clearly visible within the egg (Figure 5). Eggs of CBFW are irregularly shaped and initially appear as raised white eggs (Figure 6). As they develop, CBFW eggs go through a progressive change of color from white to yellow to orange (Figure 6-8). Within 24 hours of hatching, the developing larva's head capsule can be seen as a darkened spot within the egg (Figure 8). Eggs that have already hatched are clear, and look similar to a newly deposited egg.

Figures 3-8 Eggs of CFW (3-5) and CBFW (6-8) of CFW (top) and CBFW (bottom). Initially opaque (3 & 6), the eggs become pigmented as they mature (4 & 7). When mature the dark head capsule (arrow) is visible (5 & 8).

Larvae found within blueberry fruit in June are likely to be either CBFW or CFW. CBFW larvae are pale yellowish green, and reach a length of 15 mm when fully developed (Figure 9). CFW larvae appear pink, are about 8 mm in length, and can be distinguished from CBFW by the presence of an anal comb (hairs on the tip of the abdomen).

Figure 9. Larvae of CBFW (top) and CFW (bottom)

Life Cycle

In blueberries, both CBFW and CFW go through a single generation per year. Adult emergence begins after the start of bloom and usually before early fruit set. In West Michigan adult flight normally begins in May and continues through early July for both species. This is shown in pheromone trap catch data recorded at the Trevor Nichols Research Station.

Egg laying starts soon after the first fruit set, peaking in the first two weeks after 100 % petal fall. Although adult flight can continue into July, egg laying drops rapidly after mid June. Both species prefer to lay eggs within the calyx "cup" area of the fruit, though CBFW tend to place their eggs along the inside rim of the calyx. With favorable weather conditions, eggs hatch in 3 to 5 days. CFW tend to enter fruit in the calyx where they hatched, while CBFW tend to crawl around the berry and enter adjacent to the stem, or on the “cheek” of the berry (Figure 10). One major difference between CFW and CBFW is the number of fruit that are infested within a single life-cycle. CBFW can enter up to 6 berries, while CFW generally enter 1 or 2 berries to complete development. Both species feed on immature green fruit causing premature ripening (bluing) of fruit (Figure 11). This characteristic makes infested fruit more readily identifiable. While feeding and moving between berries, CBFW produce a characteristic mass of webbed frass, filling the space in and around the fruit cluster (Figure 11). CFW also silk berries together when moving between fruit, but the frass stays entirely within the fruit, and the webbing is not as obvious.

Upon reaching maturity, larvae leave the berries and move to over-wintering sites. The insects differ in their overwintering strategies. CFW larvae leave the fruit and enter a dead cane or weed to spend the winter, pupating in the spring. CBFW crawl to the base of the blueberry bush and form a hibernaculum in the soil (Figure 10).

Larvae begin to pupate in the spring. After a pupal stage that lasts for several weeks, the adults emerge during bloom, and mating and egg laying soon follows for both species.

Figure 10. CFW (left) enter fruit in the calyx cup and CBFW (right) enter near the stem (arrow).

Figure 11. Webbing and premature ripening of fruit caused by feeding larvae.

Monitoring and Control

Monitoring. The 3 practical phases for monitoring for CBFW and CFW in blueberries include 1) monitoring adult trap catch, 2) scouting for eggs, and 3) scouting for larval infestations.

The emergence of adult males and moth flight can be monitored using sticky traps baited with female sex pheromone lures. Monitoring the emergence of adults provides two important pieces of information for pest management. First, the number of male adults caught in traps provides a relative estimate of population level and distribution within the field. Second, because egg laying typically begins shortly after initial adult emergence, adult catch in traps serves as an indicator for when egg monitoring should begin.

The second phase of monitoring fruitworms, scouting for eggs, provides the most reliable biofix for egg hatch timing and distribution in the field. Scouting for eggs should begin after there is some early blueberry fruit set and adult flight has commenced. Start by scouting along perimeter rows of blueberries that have a history of fruitworm pressure or are adjacent to woods and/or abandoned blueberry fields. CBFW eggs tend to be laid between 3 ft and 5 ft high on bushes, and "hotspots" are often clustered together within a few bushes. Eggs can be seen in the calyx of fruit, and approximate age of CBFW eggs can be estimated by their color. CFW eggs are more difficult to see than CBFW because of their flattened shape and opaque color. A 15-20X hand lens is helpful to see eggs and confirm identification.

The third phase of monitoring fruitworm in blueberry is scouting for larval infestations. This is important for determining the effectiveness of the management strategy that has been utilized. Premature coloring of the fruit can be used to detect fruitworm infestations.

Cultural control. Clean cultivation can reduce the populations of CBFW within a field significantly, but insecticide treatments may still be needed to achieve satisfactory control of this pest. Due to the premature coloring larvae cause on fruit, it may be possible to physically remove infested clusters in small plantings.

Biological Control. As both CBFW and CFW are native insects, there are a number of parasitic insects that attack them in their egg and/or larval stages. These include parasitic wasps in the families Trichogrammatidae, Ichneumonidae, and Braconidae. Selecting insecticides that have lower toxicity to these parasitoids such as Insect Growth Regulators (IGRs) and B.t.s will enhance the effectiveness of biological control.

Chemical Control. When using chemical control, timing and coverage of the fruit is critical. Once the start of egg laying is determined through field monitoring, there is an approximate 3 to 5 day window before egg hatch begins.

Some insecticides (e.g. IGRs) are primarily active on eggs of CBFW and CFW and should be applied during this early egg-laying period. Egg hatch often occurs before 100% petal fall, so insecticides toxic to pollinators should not be used. B.t.s and most IGRs don't affect bees so they can be used during late bloom / early fruit set. Larvae are most susceptible to chemical control for a short period between the time that eggs hatch and the larvae enter the fruit. After successful larval entry, the fruit acts as a refuge from contact with chemical residues on the surface. In the case of CFW, complete coverage is critical because larvae may never leave the calyx cup before entering fruit. In the case of CBFW, it is possible to present an additional toxic dose to the larvae as they move from one berry to another, though the larvae are by then larger and more difficult to kill.

UPCOMING MEETINGS

May 17 - Blueberry IPM Scout Training, Hands-On Workshop
Meet at 1 pm at Trevor Nichols Research Complex in Fennville, then drive to blueberry farm

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

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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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