UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

Volume 28, Number 13 July 7, 2016

In this issue:

Crop conditions

Relief is nearby with thunderstorms predicted across the state in the next few days. For those with steady access to irrigation, this has been an excellent growing year with very little disease pressure and slightly higher insect pest pressure.

Pea harvests are finishing up and garlic harvest has begun for some. Beans, pickling cucumbers, and the first cherry tomatoes and peppers are coming in now. Blueberries and raspberries are ripening and boy are they tasty!

On the more challenging side of the lack of rain, farmers with crop insurance or those enrolled in the Noninsured Crop Disaster Assistance Program (NAP) are reporting losses now due to the drought. Even if you do not have crop insurance, please consider reporting crop losses and acreage to your local FSA agentas soon as possible. This is a good way to establish a planting history and can support a disaster declaration for the state or in some cases disaster funding. An update from the USDA's Drought Monitor released today indicates that almost 30% of Massachusetts (a band from eastern Franklin, Hampshire and Hampden Counties across Worcester County through Middlesex & Essex counties) is now classified as "Severe Drought". See table 1 below for a comparison of June rainfall across the state, as compared to normal. Despite rain predicted this weekend, crop losses have already occurred. We have seen effects of the drought in many crops this week. Some sweet corn is either very small or very irregular in the field making it impossible to harvest effectively with machines. Some have had to go in and reseed fall cucurbit fields with earlier maturing varieties in an attempt to get the crop to mature at the same time in the fall after very poor and erratic germination without enough soil moisture. Broccoli is trying to finish heading now but needs a good dose of moisture to do so. Fields are so dry even the weeds aren't germinating. Wind erosion has carried soil over some barren fields, increasing seeding depth and further hindering germination. Those irrigating from ponds are seeing their supply dwindle, and some towns have water restrictions that may hurt those on town water supplies (see the current MA water use restriction map). A few different town water department representatives with whom we spoke emphasized that it is important to limit daytime outdoor water use in areas where a restriction is in place. Crop losses are not the only consequence of this drought. Without rains to flush our rivers and streams, *E. coli* can build up in stagnant areas near livestock farms or where geese are settling. Pumps are at risk of sliding down river banks as water levels have receded so far. Growers are spending so much time irrigating their fields that other work is falling behind. It's raining out my window right now - hoping for more!

At least someone's enjoying the heat! These V-trellised tomatoes are growing strong. This grower likes this system for indeterminate tomatoes, since it allows her to easily support 2 main branches on each plant - they would otherwise get unweildy.

Pest alerts

Alliums: Onion thrips still present but under control in areas where it is being treated. Growers in Bristol and Franklin Cos., MA have reported lack of efficacy with spinosad. For organic growers, Azera is a material containing azadirachtin

Table 1: How Dry Was June?

Location	Normal June Rainfall	June 2016 Rainfall	% of Normal
Barre	4.24	1.60	37.7
Belchertown	4.35	2.07	47.6
Beverly	3.64	0.37	10.2
Fitchburg	4.25	1.04	24.5
Foxboro	4.32	2.08	48.1
Lawrence	4.07	1.70	41.8
Maynard	4.21	0.38	9.0
New Bedford	3.95	2.21	55.9
North Adams	4.96	2.86	57.7
Northbridge	4.20	1.86	44.3
Pittsfield	4.40	2.50	56.8
Plymouth	3.95	0.95	24.0
Vineyard Haven	3.32	0.20	6.0

Data was obtained from the Northeast Climate Center at: http://www.nrcc.cornell.edu/ wxstation/nowdata.html. The Northeast Climate Center tracks approximately 75 weather stations that track weather data in Massachusetts.

While percentages were significantly below normal in most cases, most weather stations received over 50% of the month's rainfall on one day.

Table 2. Corn pest trap counts for week of 6/29/16 to 7/6/16

Location	ECB	FAW	WBC	CEW	Spray Interval for CEW
Western, MA					
Amherst	3	-	-	-	-
Sheffield	1	2	1	-	-
South Deerfield	0	1	0	-	-
Whately	0	0	-	1.5	*6 days*
Central, MA					
Leominster	6	-	-	7	*4 days*
Eastern, MA					
Concord	0	0	-	0	*no spray*
Haverhill	5	0	-	0	*no spray*
Ipswich	2	0	-	1	*no spray*
Millis	30	-	-	0	*no spray*
Sharon	15	-	-	5	*5 days*
Seekonk	40	-	-	95	*3 days*
Swansea	5	-	-	3	*6 days*
Tyngsboro	0	0	-	0	*no spray*
NH					
Litchfield	1	0	0	0	*no spray*
Hollis	0	2	0	1	*no spray*
Cortland Co., NY	0	0	0	0	*no spray*

European corn borer (ECB), Fall armyworm (FAW), Western bean cutworm (WBC), Corn earwom (CEW)

and pyrethrin that can be used as a rotation material for spinosad. Fewer numbers are still reported on silver plastic where it is being scouted.

Brassicas: bacterial head rot was confirmed on cauliflower from Worcester Co., MA this week. Infections typically occur during long wet periods, but given the dry weather, this damage likely occurred after insect feeding on florets. Imported cabbage worm adults, eggs, larvae and now pupae, as well as diamondback moth larvae and cocoons, were seen at scouting locations around New England this week. Damage on Brussels sprouts was worse than on broccoli in two Hampshire Co., MA fields scouted this week. Treat plants between the start of heading and harvest if 20% or more of the plants are infested (one or more caterpillars present). Use a 10-15% threshold throughout the season for kale, collards and mustard.

Cucurbits: Powdery mildew **(PM) and** Cucurbit downy mildew **(CDM)** were confirmed today in a fall cucurbit field in Newport Co., RI. CDM has been confirmed on cucumber in Chatham-Kent Co., Ontario in the last 7 days. We

have scouted several fields in Hampshire, Franklin, Worcester and Bristol Cos., MA this week and no PM or CDM were found. The progress of downy mildew is tracked by the Cucurbit Downy Mildew Alert System. According to the pest forecasting model for CDM, Massachusetts was at a Moderate risk for this disease over the holiday weekend. See article this issue for more information on preventing CDM in your crop. **Squash vine borer** A new record of 133 male moths was reported this week from a trap in Hillsborough Co., NH. Northeast growers in NH are reporting 0 weekly captures while central NH to MA coast are mostly capturing moths well above threshold. We would like to print a correction to our threshold information this week after consulting Jude Boucher from CT who has done field research on SVB. **Treatment threshold is:** make the first insecticide application targeted at the base of the plant one week after 5 moths were caught for non-vining crops and 12 moths for vining crops. Only make treatments based on scouting or trap captures since pressure varies greatly from field to field even in the same town. For example, in Easton, MA this year we captured 1 SVB on 6/17, 4 on 6/23, 26 on 6/25 and 30 on 7/1. When we scouted emerging squash with 3-5 leaves on 7/1, we found up to 3 eggs per plant (photo)! Therefore, the recommended spray date for this farm was on 7/2 in order to target the eggs just before they hatch. With high trap captures of this pest occurring early in the year, keep traps up until September since a second flight is likely to emerge, which may damage fruit.

SVB eggs on squash stem. Photo, K.Campbell-Nelson

Emergence holes from 2nd generation CPB.

Solonaceous: The second generation of **Colorado potato beetle** adults and now small larvae are emerging in Franklin and Hampshire Co., MA potato and eggplant fields. The treatment threshold for large larvae is 35 on 25 stalks scouted (~1.5 larvae per stalk), or 4 small larvae per stalk. One **Pepper Maggot** adult was trapped on yellow sticky cards and stings on cherry peppers were found this week in a Hampshire Co., MA field. Make 2 to 3 applications at 5 to 8 day intervals beginning 1 week after oviposition scars are detected or when the first fly is captured. Avoid sites with horse nettle, which serves as an alternate host. Perimeter trap cropping: spot sprays limited to cherry pepper plants in row(s) surrounding main pepper crop will control this pest and spare beneficials throughout most of the field. Note: Use of selective materials for managing ECB (IGR's, spinosad or *Bacillus thuringiensis*) will not control pepper maggots. Use of Orthene (8 to 10 day intervals) for aphids or ECB during mid- to late July and early August will control pepper maggots. The solid spinosad bait, Seduce, has produced mixed results.

Pepper maggot fly on sticky card (left) and sting on pepper fruit (right)

Sweet Corn: **European corn borer** – A second flight of ECB seems to be emerging in Eastern MA despite GDD not being at 1400 base 50F - when the second adult flight is predicted to emerge - anywhere in the state. Scouting now will likely not result in finding ECB caterpillars if the first generation was effectively controlled. However, scout in the next week to look for eggs or small larvae near the silk or tucked behind the ears. **Fall armyworm** larvae were found while scouting a field in Berkshire Co., MA this week but well below threshold. **Corn earworm** traps are up in fields where there is silking corn, and captures for this pest are low except for in Seekonk, MA. One **Western Bean Cutworm** was captured in Bershire Co., MA this week. For sweet corn, consider treatment if eggs or larvae are found on >4% of plants.

WBC adult. Photo, R. Hammond

Western bean cutworm eggs. Photo, M. Rice

Multiple: Potato leafhopper nymphs and adults causing hopper burn are now present on eggplant (photo), beans, potatoes, strawberry, raspberry and young apple trees across the region. Scout now in potato, beans, and eggplant and treat at a threshold of 1 adult per stalk on potato or 1 adult per plant in beans, and 1.5 per leaf in eggplant.

* When not given here, refer to the New England Vegetable Management Guide for scouting thresholds and treatment options.

Hopper burn on eggplant. Photo, S. Scheufele.

CUCURBIT DOWNY MILDEW FORECASTING

Cucurbit downy mildew (CDM) is a disease affecting forty species of cucurbits. The disease, caused by the oomycete *Pseudoperonospora cubensis*, affects cucurbit crops in fields and greenhouses throughout the US and is especially damaging in warm, humid climates where the pathogen thrives. The disease cannot survive without a living host, so it overwinters in the south where cucurbits are grown continuously, and moves north as the season progresses. Disease spread throughout the US is now monitored annually and disease forecasts are available at cdm.ipmpipe.org. This site is maintained by the University of North Carolina and provides information about where outbreaks have been confirmed and on which crops, and provides forecasts indicating where and when inoculum might be spread based on forecast storms> there is also information on field identification and control recommendations. You can also sign up for e-mail alerts to be notified when new outbreaks occur in your area (so far none in MA). It's an excellent tool that growers can use in making crop protection decisions. So far this year, the disease has been found in FL, GA, TX, MD, NC, SC, OH, and Ontario affecting the following crops: cucumber, butternut, cantaloupe, watermelon, acorn squash, summer squash, and giant pumpkin.

Symptoms and Signs. Symptoms on cucumber and squash include angular lesions that are limited by the leaf veins. Early lesions are light green in appearance (upper and lower leaves) and become progressively chlorotic and finally necrotic as host plant cells die. During periods of leaf wetness lesions can appear water-soaked. This is the earliest symptom produced by the disease, but will disappear as moisture dissipates. Severe infection results in leaves that are completely dead and curled up, a symptom known as "wildfire", since the leaves appear to be burned. On watermelon and cantaloupe the lesions are more irregularly shaped and become brown more quickly. Symptoms are less distinctive and therefore the disease can be more easily misidentified on these crops. Sporangia and sporangiophores are most noticeable during humid conditions (e.g., morning dew or after rain) on the underside of the leaf and appears as downy, fuzzy growth within leaf veins ranging from colorless to gray-brown. In very severe infections, sporulation can occur also on the upper leaf surface, although this is uncommon.

Life Cycle. *P. cubensis* overwinters on infected cucurbits, either wild or propagated, in areas that do not experience a hard frost, such as southern Florida. Because *P. cubensis* can only survive in live host tissue, it will reach New England cucurbit fields when wind currents blow spores of the pathogen northward from host to host. The disease tends to strike in New England during late summer. Disease development is favored by mild (60-70°F), humid (38-71%) weather. At least 5 pathotypes have now been described. Cucumber and melon are susceptible to all pathotypes while squash and pumpkins vary in their susceptibility. Cucumber and melons and good crops to scout first.

Cucurbit downy mildew on upper leaf surface (top) and lower (bottom).

Management. For decades the disease was well-controlled by resistant varieties but in 2004 a new strain of *P. cubensis* evolved which was no longer effected by host resistance genes. This fact combined with resistance to the QoI (strobulurin) group of fungicides has led to the increased disease incidence and severity we have experienced in the past several years. Most cucurbit cultivars still have some level of downy mildew resistance which may delay the onset of disease or slow its progress but other control measures should be used in concert. Cultural practices to increase airflow such as trellising or increasing plant spacing should be used in field and greenhouse environments to reduce humidity and leaf wetness. Planting time can also be manipulated in some cases to avoid the disease, which occurs at around the same time each year, by

planting susceptible crops earlier in the season and resistant crops for fall harvest.

Severe infection of melon, resulting in symptom known as 'wildfire'.

Start spraying when downy mildew is found in your state. Because cucurbits form dense canopies, high pressure (at least 75 psi) and high volume (75 or more gallons of water/acre) are needed once vines touch each other. Apply fungicides long enough before a predicted rain so that the material dries rather than after it rains. Begin with a protective application on susceptible crops using a broad-spectrum fungicide such as Bravo, Mancozeb, or copper. Switch to using targeted, downy-mildew specific materials such as Ranman, Gavel (pre-mixed with mancozeb), Curzate, Tanos, Forum or Zampro always in a tank-mix with a protectant fungicide when the forecasting model predicts a high risk for CDM and it is reported in the state. Once targeted fungicides are called for, alternate modes of action with each spray, keeping a 7-day spray interval (Curzate and Tanos should be followed up with another targeted application at a 5 day interval due to limited residual). It's important to be diligent with managing fungicide resistance development because *P. cubensis* is known to rapidly evolve resistance to many chemical classes. Resistance is documented for Ridomil and the strobilurin fungicides (e.g. Quadris, FRAC Group 11), and now reduced efficacy of Presidio and Previcur Flex is being reported, indicating resistance to these materials has developed. In organic cropping systems copper products can be effective when used preventatively to protect plants from infection. Copper can be phytotoxic to cucurbits–phytotoxicity is most common during cool, moist conditions, which are also the most favorable for downy mildew. Disease forecasting should be used in any system to avoid unnecessary sprays and ensure protection from imminent infection.

See cdm.ipmpipe.org for updated disease reports and forecasts.

-by Angie Madeiras, UMass Plant Disease Diagnostic Laboratory and Sue Scheufele, UMass Extension Vegetable Program

SCARAB BEETLES: JAPANESE, ORIENTAL AND ASIATIC GARDEN BEETLES ARE ACTIVE

Japanese beetles have been flying for the past week or two. Oriental beetles and Asiatic garden beetles are also actively flying now and, though less damaging, may appear in vegetable fields as well. All species are feeding and starting to lay eggs.

Japanese beetle

There are four species of scarab beetles that are common in New England turf, fruit and vegetable crops, though none are native to the US. Japanese beetles are the most common and widely distributed but Oriental and Asiatic garden beetles are expanding their range and activity.

JAPANESE BEETLE (*Popillia japonica*) adults are about half an inch long, with a metallic green head. The wings are shiny copper or bronze color, and there are a few tufts of white "fur" along the side of each wing when it is folded back over the body. The adults are very mobile and active in daylight feeding on many different kinds of trees, fruit and flower crops. Once feeding begins, they emit aggregation pheromones attracting other beetles to the same location. Fruit (like grapes) and ornamental plants (like zinnias and sunflowers) are preferred, but beetles can congregate in vegetables also. In vegetables, adults can cause silk clipping in corn, and leaf damage in sweet basil, greens, green beans, eggplant, asparagus, rhubarb, and peppers. Though numbers may be high, there is no need to treat unless actual feeding damage is significant. In corn, if there are more than two Japanese beetles per ear and corn is less than 50% pollinated, a pesticide application may be warranted to reduce clipping and ensure

Japanese beetle larvae. Photo, D. Cappaert.

adequate pollination.

Asiatic garden beetle. Photo, M.

ASIATIC GARDEN BEETLES (*Maladera castanea* (Arrow)) are about half as long as a Japanese beetle adult, and somewhat more "plump" or domed in appearance. They are reddish-brown or copper-colored. They often are found near roots of plants when one is weeding. Adults feed at night, so one may find damage without seeing the beetles. During the day they hide in the loose soil or mulch around the base of the plants. Scout with a flashlight at dusk or during the night, or sift through soil to find them. Larvae feed on beet, carrot, corn, lettuce, onion, Swiss chard, and strawberry. Adults feed on carrot, beet, parsnip, pepper, cabbage and turnip.

Oriental beetle. Photo, S.Scheufele

ORIENTAL BEETLES (*Anomala orientalis* (Waterhouse)) fly at night, but are very active during the day as well. The beetles are smaller than Japanese beetles, mottled tan or gray with black splotches. The pattern and color varies. The antennae are branched and are quite striking if you take a close look. Oriental beetles have a long flight period – through early August – and are very mobile. Adults tend not to feed heavily in vegetable crop foliage but show up in many crops. Grubs damage may be worse in drought years and in weedy fields, but is not commonly a problem in vegetable fields and crops, though this is not well studied.

European chafer. Photo, G. Dill

EUROPEAN CHAFERS (*Rhizotrogus majalis*), a fourth species which may also be found, are slightly larger than Japanese beetles and are a fairly dull brown or tan colored. They are night fliers but can be seen in large numbers just at sunset, when they congregate in favorite trees (such as locust or willow). Adults are not foliage feeders and grubs are mostly a turf problem.

Life Cycles

The life cycle of the 4 scarab beetles we encounter in New England are similar, with minor variations. Most have a one-year life cycle, with adults emerging from the soil in early July in most of Massachusetts (later farther north) to feed and mate. The females burrow into the soil (often in or near wide expanses of grass or sod) to lay eggs which hatch into tiny grubs (cream-colored larvae, C-shaped, with brown heads) that feed on roots of grasses and other plants (they especially like corn). Grubs molt twice by the middle of September, and continue feeding until the soils begin to cool down. In late fall the third instar grubs migrate downward through the soil profile, staying below the frost line throughout the winter. Occasionally, second instar grubs overwinter in the soil, in which case, it takes 2 years for them to reach adulthood and they continue to be a root feeding problem rather than a foliar feeding problem. In the spring as soils warm up, grubs move back into the root zone and resume feeding for about six weeks. By the middle of June, most grubs have completed their feeding requirements and pupate (still in the soil) for about a week before emerging as new adults.

Management

On turf, insecticide controls normally target young grubs just as they begin to emerge from eggs in the fall. In vegetables, managing the grub stage may not be feasible (or necessary) since the grubs are most likely feeding elsewhere. Vegetable growers could run into problems with grub damage if turf or sod is plowed under in fall or spring and followed by a spring vegetable crop. A fallow or very weedy field may generate a hefty population of scarab beetles the following year.

Insecticides may be needed to control adult beetles if numbers are high and damage is significant. The New England Vegetable Management Guide lists products for Japanese and/or Oriental beetles in basil and sweet corn. For controls in a crop where these beetles are rarely a pest and therefore not mentioned in the Guide, check the label of commonly used broad spectrum synthetic pyrethroids, carbamates, and neonicotinoids (as foliar spray). Organic options include neem/azadiractin products and pyrethrin.

Biological and cultural control options do exist though are variably successful for scarab beetles. Occasionally, growers use traps to attract adult beetles, however, this may simply attract beetles into the field. Instead, it is advisable to place

these traps in locations where adults may go to lay eggs such as in lawns or at field edges through early August. The female winsome fly (*Isocheta aldrichii*) is a natural enemy of adult Japanese beetles that parasitizes adults. Look for the distinct white eggs on the thorax of adult beetles.Up to 30% control of 3rd instar Japanese and Oriental beetle grubs have been achieved by the introduced parasitic group wasp *Tiphia vernalis*. This wasp, which was released over 10 years ago, has been found in New England parasitizing grubs in early spring and summer. Beneficial nematodes (*Heterorhabditis* sp.) are commercially available for use against white grub larvae, however,scarab beetle species vary in their susceptibility to infection.

- by R. Hazzard, adapted from Turf Management Update; Pat Vittum, Turf Entomologist, UMass; Beth Bishop, Michigan State University; Michael Seagraves, Cornell Cooperative Extension; and Ann Hazelrigg, University of Vermont. Updated by K. Campbell-Nelson, 2016.

IDENTIFYING BENEFICIAL INSECTS

While scouting in the field for insect pests, also keep an eye out for the insects that are working in your favor. Your pest management decisions should be based in part on the natural controls that are already at work! It is important to be able to identify which insects are doing harm to your crops, and which are doing harm to the pests. Many different insects either prey upon or parasitize other insects that are pests of vegetable crops. Some are generalists and will feed on a variety of insect species, while others are more discriminating–this is generally true of the parasitoids, which lay their eggs within the eggs or body of a specific host. The most effective natural enemies on farms tend to be those that either consume voraciously (e.g., green lacewing larvae, which feed on aphids and many other small insects) or those that are host-specific (e.g., *Diaeretiella* spp., a wasp which parasitizes aphids exclusively). They should have high reproductive rates and life cycles that coincide with those of their hosts or prey.

Lettuce and sweet alyssum

The principals of Integrated Pest Management (IPM) include capitalizing on these natural controls to manage vegetable pests, along with using cultural practices and making strategic applications of appropriate chemical controls that interfere with the work of natural enemies as minimally as possible. The goal of IPM is not to eliminate all of the pests from a crop, but to reduce the populations of pests so that they are not causing economic losses, while maintaining enough of the pest population to sustain their natural enemies. It is often the larval stages of predators that do the bulk of the feeding; the adult stages of many beneficial species may only feed on pollen or nectar, so maintaining flowering plants– whether wildflowers at the edges of fields, or sweet alyssum interspersed within the crop– can help to provide both food and shelter for beneficial insects.

Below are a few beneficial insects that are commonly found in farm fields in New England.

Predators

Predatory Midge (*Aphidoletes aphidimyza*) adults are very small (2-3mm), delicate, mosquito-like flies with long legs and long antennae. Adults feed on honeydew (aphid excrement). The larvae are small (2mm) legless maggots, usually orange or yellow and feed mostly on aphids. Adults fly at night and are rarely seen during the day. They are active from mid to late summer. Their eggs are minute (less than 0.3mm), oval and orange, laid in clusters or singly around aphid colonies. The larvae are very successful predators of aphids and mites. In its lifetime one larva can kill 10 to 30 aphids. They are widely sold in the U.S. as an important part of biological control programs in greenhouse crops.

Predatory midge larva with aphids. Photo, A. Eaton

Hover Flies (Diptera: *Syrphidae*) (also known as Syrphid Flies or Flower Flies) are often found hovering over various flowers for nectar and pollen. Adult flies resemble bees to ward off predators. Their bodies are black or brown with distinct stripes or dots of white or yellow on their abdomen and/or thorax. Larvae are green, pink or brown in color with long tapered bodies towards the head. The life cycle varies among species and depends on environmental conditions and availability of food. Single, white

eggs are laid onto a leaf near a food source. The eggs hatch within 3 days and the larvae pass through several instars over a period of 1 to 3 weeks. They'll turn into tan-brown, teardrop-shaped pupa, either on the host plant or the soil. Larvae are voracious predators of soft bodied insects, mainly aphids. Each larva can consume up to 400 aphids during development. When hover fly larvae are abundant, the aphid population can be reduced by 70 to 100%. They are found throughout North America and often on plants attacked by aphids and other pests. Adults intentionally lay their eggs next to colonies of aphids to ensure the success of their offspring. The adults are also prominent pollinators, and are attracted to flowering plants, especially weedy borders and garden plantings. They prefer small, flat or umbelliferous flowers like wild carrot, herbs, horseradish, and wild mustard.

Syrphid fly adult. Photo, Oregon State.

Syrphid fly larva. Photo, M. Spellman.

Spined Soldier Bug (*Podisus maculiventris*) is the most common species of Podisus, a kind of stink bug, and is found throughout the United States. Adults are pale brown to tan and about 8.5 - 13mm long. They are shield-shaped with noticeable spurs on their "shoulders" immediately behind the head. What separates the soldier bug from other similar looking insects is the distinctive dark line on the tip of each forewing. Young nymphs are red and black; older nymphs have marks with red, black, yellow-orange and cream bands and patches. The nymphs are round rather than shield-shaped. Females lay hundreds of gray, cream, or gold, barrel-shaped eggs in clusters of 20-30, on leaves or twigs. Eggs hatch in 5-9 days. Growth from egg to adult lasts about 30-35 days and adults live from 1-4 months. Their prey includes over 100 different species including: European corn borer, diamondback moth, corn earworm, beet armyworm, fall armyworm, cabbage looper, imported cabbageworm, Colorado potato beetle, Mexican bean beetle. They'll target primarily immature insects with their piercing sucking mouth parts. They are recorded to have consumed over 100 late instar fall armyworm larvae during a season.

Podisus attacking CPB larva. Photo, A. Radin.

12-Spottted Lady Beetles (*Coleomegilla maculata*) are pink to red in color, oval, 5-6 mm long, and have six black spots on each forewing. The oval-shaped pronotum behind their black heads is usually pink or yellowish with two big black markings on it. The larvae of this beetle grow to about 5mm in length and are long, dark, and alligator-like. The eggs are ellipsoid and 1mm long. Twelve-spotted lady beetles overwinter as adults in large groups at field edges beneath leaf litter or stones. They come out in early spring to disperse and find sites to lay eggs and feed on pollen, insect eggs, and small larvae. Females lay their eggs (200-1000) near aphids or other prey from spring to summer. Larvae emerge from the eggs and feed on prey until they attach themselves to leaf surfaces to pupate. The pupal stage lasts 3-12 days, then, adults emerge and live for close to a year. Two to five generations of these lady beetles may occur each year. Twelve-spotted lady beetles are most important as predators of aphids, but they feed on mites, insect eggs, and small larvae as well. Plant pollen makes up a larger part of their diet than it does for other lady beetles, which allows their populations to build up in high pollen crops such as corn. Their searching ability for prey egg masses is excellent and they can contribute significantly to mortality of Colorado potato beetle eggs and small larva.

12-spotted lady beetle eating CPB eggs. Photo, M. Spellman

Multicolored Asian Lady Beetles (*Harmonia axyridis*) are convex in shape and somewhat larger than native lady beetles at 7mm long and 5.5mm wide. Their wings are colored yellow, orange, or red and may or may not have black spots on them. They can have up to 19 spots, but their appearance is quite variable throughout the species. A disk-shaped pronotum covers their head. The pronotum is cream or yellow in color and has a distinctive black design on it that is shaped like an 'M'. The larvae of these beetles are long, flat, and black with orange markings and black spines. Eggs are ellipsoid

and yellow and found in clusters of twenty or so. Asian lady beetles cycle from egg to adult in about a month and multiple generations of these beetles occur every year. Eggs are laid underneath leaves of various plants. In three or more days they hatch and the larvae thrive on aphids for about two weeks. The beetle then enters the pupal stage, from which adults emerge after several days and live for about a year. Adults overwinter in sheltered locations (including indoors) and mate in the spring. These beetles prey on aphids and scale insects especially. They are not native and are considered both beneficial (for their predation on pest insects) and a nuisance (because they often overwinter in large groups in houses, and because they can be a pest in grapes).

Lady beetle pupa - sometimes mistaken for CPB larva! Photo, J. Boucher.

Multicolored Asian lady beetles. Photo, ipm images.

Green lacewing (*Chrysopa* and *Chysoperla* spp) adults are pale green, with a slender soft body, about 1/2" long, and four delicately veined wings. Eggs are laid on filamentous stalks attached to plant tissues. Eggs hatch about 4 days after being laid. Larvae are alligator-like, with a flattened body that tapers at one end, have long, curved mandibles, and are usually pale with darker markings. They measure from 1/8 to 4/5 of an inch. Larvae develop through three instars, and then pupate in silken cocoons attached to plants. The adults of most species are not predaceous, feeding mostly on nectar and pollen. The larvae, however, are voracious predators, and will consume large numbers of a wide range of soft-bodied insects, including other lacewing larvae. Lacewings are found naturally in New England, and are also available commercially, as they are very effective at cleaning up outbreaks of aphids and other pests in greenhouses.

Green lacewing eggs on onion. Photo, L. McKeag.

Parasitoids

The beneficial parasitoids that are important in vegetable crops aren't often seen as most of them are tiny wasps. There are thousands of species of parasitic wasps, most of which are highly specialized to use a particular species or family as a host. Several species are naturally occurring in New England, or have been successfully introduced, and others are commercially available for release. These wasps lay their eggs in either the eggs or larvae of their hosts, where the wasp larvae feed on the insides of the host, and pupate in or on the host before emerging as adult wasps. Often what will be visible in crops to indicate parasitoid activity will be either the parasitized host or the pupating parasite.

Cotesia *wasp eggs. Photo, M. Gaia*

Caterpillars are commonly parasitized by braconid and icheumonid wasps. The braconid wasp, *Cotesia rubecula*, was introduced to New England from China in 1988, and is now established in Massachusetts. This wasp parasitizes imported cabbageworm larvae. You may see their small white cocoons on brassica leaves. Diamondback moth eggs are parasitized by the ichneumonid wasp, *Diadegma insulare*, which occurs naturally in Eastern North America. *D. insulare* females require sources of nectar to be effective DBM parasitoids, so maintain wildflower stands near brassica fields to encourage their activity. You may be more familiar with the pupae of another parasitic wasp, *Cotesia congregatus*, which lays its eggs under the skin of the tomato and tobacco hornworms. The larvae feed within, then emerge to pupate on the surface, eventually killing the host. If you see a hornworm in your tomato crop with many white cocoons on its back, don't kill it – either leave it be, or move it to another area where it can't continue feeding, to allow the wasps to develop.

Parasitized tomato hornworm

Aphids also have many parasitic wasps that rely on the aphids' bodies to produce and

feed their young. If you see puffy, tan or golden aphids among an aphid colony, these are aphids with one of these wasps pupating within, and are called aphid "mummies". Sometimes you will see a small hole in the mummy, indicating that the adult wasp has emerged. The braconid wasp *Diaeretiella rapae*, parasitizes many species of aphid, but is particularly fond of cabbage aphids. Keep an eye out for these mummies when scouting for aphid colonies to get an idea of the level of the biological control you're getting.

Melon aphids with aphid mummies. Photo, A. Radin

Aphidoletes *adult wasp. Photo, J. Gross, bugguide.net*

-by Lisa McKeag, UMass Extension, and Kristina Fahey and Ayana LaSalle, Stockbridge School of Agriculture Students

AGRICULTURAL FOOD SAFETY PROGRAM (AFSIP) DEADLINE EXTENDED!

MDAR's AFSIP Grant deadline has been extended to August 12th, 2016!

MDAR will be accepting applications from agricultural operations who wish to participate in the Department's Agricultural Food Safety Improvement Program (AFSIP). Interested operations are encouraged to review the application on the website. If interested in applying, applications must be submitted with any additional documentation by the new deadline of Friday, August 12th, 2016.

The purpose of the AFSIP grant is to support produce and aquaculture operations in implementing enhanced food safety measures that help reduce food safety risks and help to minimize microbial contamination and food-borne illnesses. In addition, by implementing eligible upgrades that help reduce a food safety risk, the program helps operations maintain or increase their market access.

AFSIP is a competitive, re-imbursement grant program that funds projects up to $20,000 or 75% of total project costs. This round of funding has an application deadline of August 12th, 2016 and projects must be completed by June 30th, 2017.

NOTE: For those applicants who have already submitted their applications you may: 1.) Leave your application with us as is or 2.) Re-submit a new application, to modify what you already submitted or to include any new or additional information you may want to provide.

AFSIP grant applications are available at www.mass.gov/eea/agencies/agr/about/divisions/afsip.html.

EVENTS

Conservation Biological Control Short Course

When: Monday, July 11th, 2016 from 9:00am to 4:30pm

Where: New England Wildflower Society Garden in the Woods Framingham, Massachusetts

This workshop will cover:

- The importance of beneficial insects - predators and parasitoids that attack insect pests.
- Overview of conservation biological control and integrated pest management (IPM).
- How to identify beneficial insects and distinguish them from other insects.
- How to recognize the habitat needs of beneficial insects and identify habitat deficiencies.
- The design and implementation of habitat improvements, including site preparation, insectary strip plantings,

hedgerows, beetle banks, and more.

- The current best management practices that minimize land-use impacts on beneficial insects and mitigate exposure to insecticides.
- How to access USDA conservation programs for financial and technical support.

Participants will receive the Xerces Society's Conservation Biological Control Toolkit which includes habitat installation guidelines and other relevant publications, and the Xerces' book, *Farming with Native Beneficial Insects*.

Instructor: Jarrod Fowler, Pollinator Conservation and Conservation Biological Control Specialist for New England and Northeast Regions at The Xerces Society and a Technical Service Provider at USDA-NRCS.

Continuing Education Credits Available *Certified Crop Advisor (6 CEUs) Pesticide Applicator Continuing Education (PACE) (5 CEUs)*

Cost: $45 **Register by clicking here!**

How to Conduct an On-Farm Trial

When: Tuesday, July 12th, 2016 from 3:00pm to 5:00pm

Where: UMass Crop and Animal Research and Education Center, 89 River Rd. Deerfield, MA

Ever want to apply for a SARE farmer or partnership grant? Looking to improve your farming practices through research? This workshop is for you! Farmers and Agricultural Service Providers welcome. We will provide hands-on training in setting up a replicated field plot, and include practice taking measurements and collecting data. Concepts learned can help you answer many questions through on-farm trials, but this workshop will focus on the UMass trial "**Nitrogen contribution from cover crops for vegetable crop uptake**" being conducted on multiple farms in Massachusetts this fall as a way to prepare cooperating farmers to conduct this trial.

Stay tuned for a follow-up workshop on data analysis and interpretation of results.

Free, but please RSVP: https://www.surveymonkey.com/r/OnFarmTrial

Questions? Contact: Katie Campbell-Nelson, kcampbel@umass.edu, 413-545-1051

Supported in part by USDA/NE-SARE Professional Development MA State Program.

Cocktail Cover Crops: Trials and Techniques

When: Monday, July 25th, 2016 from 1:00pm to 5:00pm

Where: Many Hands Organic Farm, 411 Sheldon Rd Barre, MA

Multi-species cover crop cocktails can create synergistic ecological benefits for your farm or garden - enhancing biodiversity, efficiently capturing and recycling nutrients, and sequestering carbon in the soil. This workshop will explore how to select, mix, and establish various cover crop mixtures. We will also discuss assessment and quantifying how your cover crop practices are impacting soil health. **Instructors:** Ray Archuleta, NRCS Conservation Agronomist Greensboro, NC; Brandon Smith, NRCS Northeast Region Team Leader for Soil Health Division; Masoud Hashemi Associate Professor UMass Stockbridge School of Agriculture; Julie Rawson NOFA/Mass executive director.

Cost: NOFA/Mass Member - $38 (walk-in $43) Non-member - $50 (walk-in $55)

Pre-registration is recommended. For more information contact Dan Bensonoff, Education Events Organizer, at dan@nofamass.org or 860-716-5122.

IPM Field Walks

In this series, learn to identify and scout for vegetable pests and select integrated pest management strategies that work for you, whether you are an experienced farmer, or just starting out, organically certified or not! We will use pheromone traps to monitor pests, use a microscope to identify plant pathogens, and learn to scout in multiple vegetable crops with UMass Extension Vegetable Program staff Katie Campbell-Nelson, and Plant Diagnostician Angie Madeiras. Scouting will be followed by a discussion of effective control strategies with growers in attendance. Bring a

hand lens if you have one. *Supported in part by funding provided by USDA-NIFA Extension Implementation Program, Award No. 2014-70006-22579*

** *All field walks have been approved for 2 pesticide credits in the vegetable category*

July 19th, 4-6pm
Alprilla Farm, 94 John Wise Avenue, Essex, MA 01929
Farmer: Noah Kellerman

August 2nd, 4-6pm
Red Fire Farm, 184 Meadow Rd, Montague, MA 01351
Farmer: Ryan Voiland

Questions? Contact: Katie Campbell-Nelson, kcampbel@umass.edu, 413-545-1051

Twilight Meeting: Equipment for Mechanical Cultivation & Product Washing and Packing

When: Wednesday, August 10, 2016 from 4pm to 6pm

Where: Tangerini's Spring Street Farm, 139 Spring St, Millis, MA 02054

Tangerini's Farm is a 65-acre farm located in Millis, Ma. Produce is marketed through a 500 member CSA, an on-site farm stand, farmers' markets, food coops and wholesale buyers. Over the last two years, with support from an MDAR Food Safety Improvement Program grant, they have developed a washing and packing area to prepare all their produce. They will demonstrate the use of many pieces of equipment including wash tanks, barrel washer, bunch washer, onion topper and a conveyer system. They will discuss the flow of produce in the packing area as well as how it is stored. They will also show off some new investments and innovations in their cultivation equipment.

Lisa McKeag, from the UMass Vegetable Program, will also provide an update on the roll-out of the Food Safety Modernization Act (FSMA) in Massachusetts.

Contact Lisa McKeag at lmckeag@umext.umass.edu or 413-577-3976 for more information.

Sponsors

Vegetable Notes. Katie Campbell-Nelson, Lisa McKeag, Susan Scheufele, co-editors.