UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

Volume 33, Number 14 July 22, 2021

In this issue:

Scouting in a flooded tomatillo field in Franklin County. Photo: H. Whitehead

Mexican bean beetle larva

Crop conditions

It felt like the rain might never stop this past week – most locations across the state got another 1-2 inches of rain, bringing the total rainfall in July to more than 10 inches in some locations. Despite drier weather over the last few days, even lighter soils are waterlogged and many fields are still flooded. But farmers are persisting! Crops are still rolling in—we saw eggplant being harvested, the fruit above the waterline due to raised beds, by a crew knee-deep in water in the aisles. We are continually impressed by farmers and crops alike, powering through and producing so much food despite extreme environmental conditions. We are seeing widespread yellowing in some crops on some farms, likely caused by soil nutrients being washed away through the soil or through runoff, but other crops are lush and green. One farmer we spoke to this week reported relatively low insect pressure this year – insects tend to be less active in the rain, and entomopathogenic fungi thrive in this wet weather. And, this grower told us, "at least we don't have to worry about irrigation!"

Pest alerts

Basil

We received a report last week of **basil downy mildew** on 'Devotion', a variety that should display a high level of resistance to basil DM. Usually, growers get a few weeks of production out of DM-resistant varieties but it seems like the long period of wet weather likely shortened that time.

Beans

Mexican bean beetle larvae are now present in bean crops. MBB can be controlled using the biological control *Pediobius foveolatus*, a parasitic wasp. The wasps should be released to coincide with MBB egg hatch, so depending on how far along the pest is in your field, it may be too late to get effective control using *Pediobius* this season. Chemical control is warranted at >20% defoliation pre-bloom or 10% defoliation during pod formation. There are many listed materials that will also provide control of potato leafhopper—see the bean insect control section of the New England Vegetable Management-Guide for more info. Azadirachtin products, or azadirachtin + pyrethrin can provide control for organic growers.

Brassicas

Brassica downy mildew was reported in brassica transplants in a greenhouse in MA this week. This disease has occurred for several years in a row in this greenhouse, leading us to believe that it is overwintering there. Brassica DM causes yellowing on the top of leaves and forms white, crusty sporulation on the undersides of leaves. Irregular, black, lace-like lines sometimes form within sporulating areas. Potential sources of the disease include

Contact Us:

Contact the UMass Extension Vegetable Program with your farm-related questions, any time of the year. We always do our best to respond to all inquiries. **Office phone:** (413) 577-3976 *We are currently working remotely but checking these messages daily, so please leave us a message!* **Email:** umassveg@umass.edu

Home Gardeners: Please contact the UMass GreenInfo Help Line with home gardening and homesteading questions, at greeninfo@umext.umass.edu.

contaminated seed, overwintered infected plants, oospores in crop debris, and wind-blown asexual spores. We most often see brassica DM in the spring and fall, when temperatures are cool.

Brassica downy mildew sporulation. Photo: G. Higgins

Cucurbits

Cucurbit downy mildew was reported in additional counties in NY (Erie and Niagra Cos.) this week, as well as in Newport Co., RI. One report from NY was on 'Bristol' cucumber, which has some resistance to the disease—this implies that disease pressure in that area is very high and conditions are highly favorable for disease development. In the Northeast currently, cucumber and cantaloupe are most at risk for disease. Scout cucumber and cantaloupes regularly for CDM now and report suspected infections to us at umassveg@umass.edu. On cucumber, the disease will cause angular yellowing on the top side of the leaf, and gray sporulation on the underside. In cantaloupe, lesions are more irregularly shaped, turning brown. MA is currently at high risk for CDM development in cucumber and cantaloupe.

Plectosporium blight is showing up in cucurbit fields now. This is a fungal disease that causes elongate, white lesions on cucurbit petioles and later, on fruit. The pathogen overwinters on crop residue and spores produced on infected crops are spread to new fields by wind. Rotate away from summer squash and pumpkins for 2 years. Choose sunny, well-drained sites for planting cucurbits. Fungicides can control this disease if applied when symptoms are first observed; thorough coverage is essential. The strobilurin (QoI) fungicides Flint (trifloxystrobin), Cabrio (pyraclostrobin), and Quadris (azoxystrobin) will control this disease but should not be rotated with each other or the pathogen will develop resistance. Apply a protectant fungicide such as chlorothalonil (Bravo) or mancozeb (Dithane) following a strobilurin. See the pumpkin, squash, and gourds disease control section of the NE Vegetable Management Guide for labeled materials.

Plectosporium on zucchini. Photo: G. Higgins

Squash vine borer larvae are quite large now and are causing significant damage feeding within stems. In small plantings, finding infested plants and killing larvae can help to reduce the size of the resident SVB population. If you are monitoring SVB on your farm using pheromone traps, insecticide sprays targeting the base of the plant are warranted as long as trap captures exceed 5 moths/trap/week for bush-type varieties and 12 moths/trap/week for vining types.

Squash bug nymphs are being seen now in cucurbit crops, as well as more adults and eggs. Insecticide sprays are most effective if targeted at small larvae. Labeled materials include pyrethroids/pyrethrins and neonicotinoids. Take measures to protect pollinators by avoiding spraying flowering crops or spraying after dusk when pollinators are not visiting flowers. For organic growers, pyrethrin (e.g. Pyganic) will kill squash bugs on contact, or azadirachtin products will inhibit growth and molting of nymphs.

Squash bug eggs and nymphs.

Table 1. Squash Vine Borer trap captures, week ending July 21, 2021

Location	SVB
Deerfield	8
North Easton	16
Westhampton	14
Whately	0
Sharon	3
Leominster	-

Solanaceous

Tobacco mosaic virus (TMV) was diagnosed in field tomatoes in Hampshire Co. this week. TMV can infect other solanaceous crops as well and is spread mechanically, by people or equipment moving through fields. It is not vectored by insects, as some other viruses are. Many floriculture crops are susceptible and it is commonly spread through vegetative propagation. It can spread to vegetable crops when the two are grown in greenhouses together. Tobacco is a host as well, and TMV can be carried on tobacco products. Symptoms can vary widely but include stunting, mosaic patterns on foliage, and leaf malformation, especially at growing points. Many of these symptoms can also be caused by environmental factors, insect damage, herbicide damage, and other factors, so TMV cannot be diagnosed by looking at symptoms alone. There is no cure for TMV, so management is achieved by avoiding infection by rogueing out suspect plants in the greenhouse, sanitizing pruning equipment, washing hands after using tobacco products and before working in tomato crops, and managing weeds that can harbor TMV.

Table 2. Sweetcorn pest trap captures for week ending July 21

Location	GDD (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
Western MA						
Deerfield	1436	0	0	2	4	*5 days*
Southwick	1217	0	0	0	1	*no spray*
Whately	1487	10	1	0	0	*no spray*
Central MA						
Bolton	1406	4	0	-	0	*no spray*
Lancaster	1374	6	0	0	2	*6 days*
Leominster		3	0	-	-	-
Northbridge	1279	1	0	0	2	*6 days*
Spencer	1357	0	0	0	1	*no spray*
Eastern MA						
Ipswich	1313	0	0	0	12	*4 days*
Concord	1394	0	0	1	0	*no spray*
Millis	-	0	1	N/A	2	*6 days*
North Easton	1425	0	0	-	2	*6 days*
Sharon		0	0	N/A	-	-
Seekonk	1570	0	0	0	0	*no spray*
Swansea		0	0	-	2	*6 days*

- no numbers reported for this trap
N/A this site does not trap for this pest

*GDDs are reported from the nearest weather station to the trapping site

Verticillium wilt is widespread in eggplant crops now. Verticillium is often described as causing one-sided wilt, where one half of a leaf will collapse and the other half will look normal. It can also cause light-green mottling, as well as more general chlorosis and necrosis between the major leaf veins (see photos). Verticillium wilt is difficult to manage as it has a wide host range including solanaceous crops and many weeds and there are no effective chemical controls. Some eggplant varieties tolerate the disease better than others.

Verticillium showing symptoms other than one-sided wilt in eggplant. Photos: K. Brow (left) and J. Schneider (right)

Stemphylium leaf spot was confirmed this week in tomato in RI. This is a relatively uncommon leaf spot on tomato but was found last year in one field in MA. The fungus that causes this disease can be seed-borne and that may be the source of the pathogen in these cases. Stemphylium causes small brown spots on tomato leaves, that turn gray as they enlarge. The centers of the spots often crack, and fuzzy gray growth is sometimes present on the surface. It can look similar to early blight, Septoria leaf spot, and bacterial pathogens of tomato. If you suspect this disease in your tomato, let us know at umassveg@umass.edu Management of Stemphylium leaf spot is similar to that of early blight and Septoria in tomatoes. See our Fungal Leaf Spots of Tomato article for management recommendations.

Stemphylium left spot. Photo: G. Higgins

Sweet corn

European corn borer numbers are starting to increase again on some farms, with pheromone traps beginning to capture second generation moths now. **Corn earworm** trap counts are remaining relatively low, with most locations requiring no spray or at a 6-day spray interval. One trapping location reported 12 CEW in their trap this week **Fall armyworm** traps are up now, with only 1 location reporting trap captures. Sprays dictated by CEW trap counts should control ECB and FAW as well. FAW and CEW can have resistance to synthetic pyrethroids, so do not use pyrethroids alone for caterpillar management.

WHACK OUT WEEDS IN WET WEATHER

With all of the rain most of Massachusetts has seen over the past few weeks, growers are having trouble getting into their fields to cultivate or spray herbicides. On farms that had pretty good weed control before the rain started, the weeds haven't gotten too big but the growers we've talked to are concerned that they'll take off while they're catching up with other tasks like the plantings that they haven't been able to get into the ground. Here are some thoughts on tackling weeds under all this water.

Herbicides and cultivation: When it comes to weed management, excess water is more of a problem than too little water. For those using preemergence herbicides, rain or overhead irrigation allows herbicides to be activated where weeds are germinating in the top few inches of soil. Excess rain can move the herbicide below that zone and control will be reduced. When weeds emerge after the crop is up, there are a few options left. First, cultivate whenever it is dry and sunny; take advantage of those few days and don't delay. Weeds die better when they are small. Remember not to cultivate too deeply, as deep cultivation destroys crop roots and brings new weed seeds closer to the soil surface.

Second, check the New England Vegetable Management Guide for postemergence herbicide options for specific crops. Just about every crop has a postemergence grass herbicide option available. Depending on the crop, these products include Poast (sethoxydoim), Fusilade (fluazifop), Select (clethodim), Assure (quizalofop), and for sweet corn only, Accent Q (nicosulfuron). Grass herbicides work best on actively growing grasses BEFORE they flower and make seeds. Depending on the crop, broadleaf weed options may include nonselective herbicides (which work on all plants, including the crop) like Aim (carfentrazone) and Roundup (glyphosate), as well as more selective herbicides (which work on weeds and are safe on crops) like Stinger (clopyralid), Sandea (halosulfuron) and Impact (topramezone), among others. Some herbicides are labeled for use on the crop, while others are only labeled for use between rows. Make sure to read the label carefully before using any product. As with cultivation, small weeds die easier and faster than big weeds, so don't delay if you have a dry window. Herbicides are typically no longer an option after the weeds are taller than 6", and better control is achieved if they are between 1-3". If using an herbicide, always refer to the most recent product label.

Hand weeding is always an option but take care not to drop those weeds back onto the soil where they might take root again. Consider using buckets or a wheel barrow to remove the weeds from the field. Prioritize removing weeds before they go to seed. Flowering galinsoga will produce seed if left in the field even after you pull it, so be careful to remove these from the field. When pulling weeds from the holes on plastic mulch, shake the weeds to remove excess soil and then place the weeds on the plastic where they have a much greater chance of dying.

There are other options for managing weeds at this time of year—mowing and burning! The following is excerpted from the article When the Time Comes to Hand Pull Weeds, from the USDA-ARS Integrated Weed Management Resource Center:

Mowing: "An option for late-season management is to mow the area of the field that contains a severe infestation. If the weeds have not yet produced seeds, this should substantially decrease the quantity of dropped seeds. The grower would need to weigh the cost of terminating the crop where the infestation exists, but should keep in mind that preventing this weed infestation now can save a substantial amount of money on weed control next year.

Burn! When faced with a severe mature infestation that has produced seeds, a grower may choose to not only mow the affected section of the field, but also burn the mowed weeds in piles or windrows. Burning this weedy plant matter at sufficiently high temperatures kills the weed seeds. Temperatures of 800-900 degrees F are required to kill most weed seeds. In order to achieve this temperature range, it is important to form the plant matter in windrows or piles and then wait for it to dry, in order to create the density and dryness needed. Windrows may also be formed at harvest-time and

then burned – this technique is referred to as "narrow windrow burning." It is becoming widely adopted in Australia, and is being tested by Virginia Tech and the University of Arkansas for use in US cropping systems.

While late-season control measures are labor-intensive, eliminating escaped weeds is an important measure for preventing seed dispersal and new infestations especially in no-till fields. Just a few plants can produce enough to infest an entire field in a couple of seasons. Manual removal this year could save significant money, time, and labor in future years.

--Written by Rich Bonanno, content updated by Katie Ghantous and Katie Campbell-Nelson, 2018

BACTERIAL DISEASES OF TOMATO (AND PEPPER)

Three bacterial diseases commonly affect tomato crops: Bacterial spot, bacterial speck, and bacterial canker. Bacterial spot and speck are less damaging than bacterial canker—spot and speck will less frequently take out an entire tomato planting whereas canker can cause total crop losses. Tomato pith necrosis is a less common bacterial disease that can be confused with bacterial canker. These diseases can affect foliage, fruit, and stems and can also increase incidence of sunscald on fruit as foliage is lost.

In general, bacteria do not survive well on their own, outside of a host plant or crop debris. Thus, the most common starting place for any bacterial disease is in the seed itself, so starting with clean seed or hot water treating your seed is very important. If you are buying transplants, ask your supplier about their bacterial disease control strategies–greenhouses are ideal places for growing and spreading bacteria, as they thrive in warm, humid conditions. Other sources of bacteria may be infested crop residues in the soil and equipment, especially wooden tomato stakes. If you've had bacterial diseases in past years, do yourself a favor and replace your stakes or invest in metal stakes which are easier to disinfect each year.

Once bacteria are present, they are spread mainly by movement of water or plant sap–this means rain splash or driving rain, wind-driven sand, or by movement of workers or equipment (tractors, pruning shears etc.) through a wet field, and even in aerosols in humid air. Bacteria infect plants passively, via open stomates and hydathodes, or wounds. Bacteria thrive in warm (around 75-90°F), moist or humid conditions. Management of bacterial diseases is difficult once they are established, so preventing disease from starting by using good sanitation practices is key. Good sanitation practices include buying clean seed, hot water treating seeds, controlling weeds, sanitizing equipment, and rotating crops is essential to preventing disease.

Below, symptoms of the most common bacterial diseases of tomato (and pepper in the case of bacterial leaf spot) are described:

Bacterial spot caused by *Xanthomonas campestris* pv. *vesicatora* (Xcv) affects both tomato and pepper and is one of the most devastating diseases of these crops in warm, humid environments. There are several different strains of Xcv that vary in their pathogenicity to tomato, pepper, and solanaceous weeds. Some strains infect only pepper, some infect only tomato, and some can infect both pepper and tomato. Pepper cultivars are available with resistance to bacterial spot, however they are usually resistant to specific races of Xcv so controlling this disease with resistant varieties effectively requires knowing what races of the pathogen are likely to be present.

Bacterial leaf spot on pepper

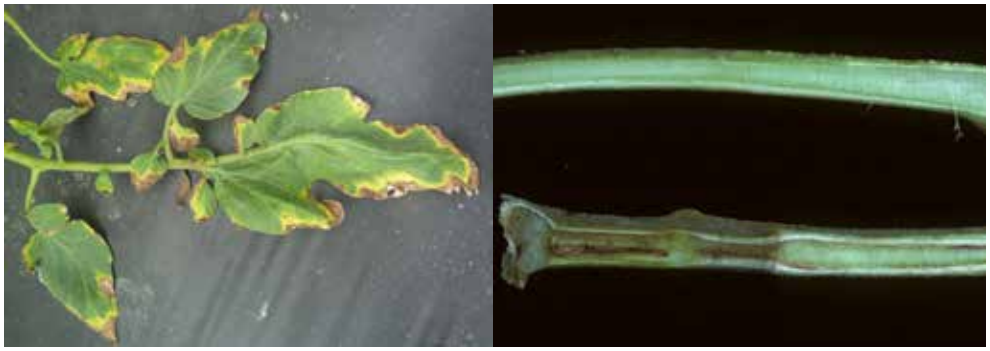
On leaves, symptoms start as small yellow-green spots that quickly turn brownish-red and may have a greasy, water-soaked appearance. Bacterial spot lesions do not have concentric rings or a prominent halo. When conditions are optimal for disease development, spots can coalesce to form long, dark streaks. On tomato plants, a general yellowing may appear on foliage with many lesions giving the plants a scorched appearance, and the plants may exhibit severe bending and twisting. On pepper plants, affected flowers, fruits, and leaves drop prematurely. This can reduce yield directly and severe defoliation of plants can lead to sunscald of surviving fruit. On tomato fruit, discrete, minute, slightly raised blisters occur on green fruit only. Initially, lesions have a yellow halo that resembles the birds-eye spot caused by bacterial canker. As fruit lesions enlarge, they lose their halo and become

brown, raised, and scab-like on ripe fruit. On pepper fruit, spots begin as pale-green, water-soaked areas, which eventually become raised, brown, and roughened. Spots may provide entrance points for various fungi and bacteria that cause secondary fruit rots. The bacterial spot pathogen alone does not cause fruit rot.

Bacterial speck on tomato. Photo: M.T. McGrath

Bacterial speck (*Pseudomonas syringae* pv. *tomato*) causes a fruit spot and foliar blight on tomato only, not pepper. It is found wherever tomatoes are grown. Lesions are indistinguishable from those caused by bacterial spot–small, greasy or water-soaked spots which develop a halo over time. Spots may coalesce, killing large areas of tissue. On fruit, small (1/16 inch), dark spots or specks develop with the tissue around them often more intensely green than unaffected areas. These tiny, dark spots are not raised or scabby at all like those caused by bacterial spot. Only green fruit is susceptible to infection.

Bacterial canker (*Clavibacter michiganensis* pv *michiganens*is) is one of the most destructive tomato diseases in Massachusetts. Symptoms are different in the greenhouse versus in the field. Infections arising from contaminated seed or seedlings result in systemic spread of the bacteria within the plant, and seedlings can be affected early on in the greenhouse. This type of systemic infection (known as primary infection) causes stunting, wilting, vascular discoloration, open stem cankers, and fruit lesions. If an infected stem is cut lengthwise, a light brown discoloration may be present in the vascular tissue, which is just inside the stem skin. Vascular discoloration is most noticeable at nodes and just above the soil line. Secondary infections occur in the field when bacteria are spread from plant to plant by splashing rain, driving winds, workers and equipment, or in aerosols under humid conditions. Secondary infection often results in marginal scorch where leaf edges are brown to black with a yellow border on the leaf interior. Spots also occur on green fruit and are very characteristic–white to yellow spots, 3-4 mm in diameter, with raised brown centers and white haloes, known as "bird's eye spots."



Signs of bacterial canker: marginal necrosis (left) and vascular discoloration (right) Photos: S.B.Scheufele (left) and R.L.Wick (right)

Clockwise from upper left: bacterial canker, spot, and speck on tomato fruit. Photo: R. L. Wick

Tomato pith necrosis is caused by *Pseudomonas corrugata* and other soil-borne species of *Pseudomonas*. While high tunnels and greenhouses provide ideal conditions for the growth of early season tomatoes, the high tunnel environment is also ideal for the development of pith necrosis. This disease generally occurs on early-planted tomatoes growing when night temperatures are cool, humidity is high, and plants are growing vigorously because of excessive nitrogen levels. The disease is also associated with prolonged periods of cloudy, cool weather. The initial symptoms of pith necrosis are yellowing and wilting of young leaves; this often appears just as

Signs of pith necrosis: stem lesion (left) and adventitious roots and hollow stem (right). Photos: S.B. Scheufele

the first fruit clusters reach the mature green stage. Serious infections can result in yellowing and wilting of upper portions of plants, with brown to black lesions forming on infected stems and petioles. When stems are cut longitudinally, the center of the stem (pith) may be extensively discolored, hollow, and/or degraded. Stems may be swollen, numerous adventitious roots can form, and infected stems may shrink, crack, or collapse. The epidemiology of this disease is not well understood; it is possible that the bacteria are seed-borne and most certainly survive in the soil in association with infected tomato debris.

Preventive measures to minimize the occurrence of **pith necrosis** in high tunnels include:

- Provide adequate ventilation to avoid high humidity levels (especially during cloudy weather)
- Avoid excessive nitrogen levels to prevent unnecessarily vigorous plant growth. The nutrient recommendations for high tunnel tomatoes were updated in the most recent edition of the New England Vegetable Management Guide—see the outdoor tomato section for details.
- Incorporate crop debris to speed decomposition of residue and associated bacteria
- Use crop rotation

There is no effective treatment for this disease. Affected plants may recover if environmental conditions improve (warm, sunny weather) but if not, affected plants should be removed from the field to prevent spread of the disease.

Preventing losses to bacterial diseases:

- **Start with certified, disease-free seed or treat seed with hot water.** See the fact sheet entitled Managing Pathogens Inside Seed with Hot Water for further details.
- **Resistant varieties:** Pepper varieties are available with resistance to various strains of bacterial leaf spot. There are a few tomato varieties with resistance to bacterial speck, but none with resistance to spot, canker, or pith necrosis. Cornell Cooperative Extension has compiled lists of resistant varieties here.
- **Rotate** out of tomatoes (and peppers, for bacterial leaf spot) for at least 2 years. Control for solanaceous weeds to prevent the pathogens from surviving on weed hosts.
- **Use new tomato stakes every year or sterilize stakes before reusing.** See the article How to Disinfect Stakes Before Reuse from University of Delaware Extension for more info.
- **Reduce moisture and increase airflow in the crop.** In high tunnels, heat and vent to reduce moisture and remove lower leaves to increase airflow. In the field, increasing spacing can increase air flow. Control weeds in both settings.
- **Control bacterial diseases in transplant production.** Inspect transplants before planting out into the field or high tunnel and do not plant suspect transplants. But be aware that young infected transplants may be asymptomatic.
- **Use drip instead of overhead irrigation.** If you must use overhead irrigation, irrigate at midday on sunny days so foliage dries out before going into an overnight dew period.
- **Sanitize shears or change gloves at the end of each row if pruning.**
- **Avoid working in fields when bacterial diseases are present and foliage is wet.**
- **Promptly incorporate crop debris after harvest.** If you have confirmed, widespread bacterial disease in a high tunnel, removing the crop residue from the tunnel may be more effective.
- **Chemical control:** In general, bacterial diseases of field crops are difficult to control with pesticides. If chemical control is going to be effective, it must be implemented early on, when symptoms first appear; when a significant amount of disease is present, pesticides are usually not effective. Copper products are most effective, and the addition of mancozeb products can increase their efficacy. Streptomycin (e.g. Agri-mycin 17) is an effective product that may be used only in the greenhouse before transplanting to the field. Biological disease control products that have shown efficacy in some trials on bacterial diseases in tomato include Actigard or Regalia (both plant defense activators). Do not use air blast sprayers to apply fungicides as they can spread the bacteria through the field.

--UMass Vegetable Program

PEPPERS: WATCH FOR PEPPER MAGGOT & EUROPEAN CORN BORER

There are two larval pests that commonly affect pepper fruit in Massachusetts—pepper maggot and European corn borer (ECB). Damage from these two pests can appear similar. We are entering pepper fruiting season, so pepper maggot flies should be emerging, and the second flight of ECB is beginning now. If you've struggled with rotting pepper fruit that reveal caterpillars or maggots when cracked open, start monitoring your crop now to watch for these pests.

Pepper maggot (*Zonosemata electa*) adults emerge in mid- to late-July and are active for several weeks. Larval damage is limited to solanaceous plants, including ground cherry, horse nettle, tomato, pepper, and eggplant. Pepper is the preferred host and green bell peppers and cherry peppers are especially susceptible.

Pepper maggot fly
Photo: S. Scholnick

The pepper maggot fly is found throughout eastern North America and its range within New England has been creeping northward and now extends into southern New Hampshire and throughout Massachusetts. Activity of this pest is very localized, and varies by farm, region, and year. Many farms never have a problem with this pest. Other farms may have it and not realize it, because it is possible to confuse maggot damage with damage caused by ECB. The best way to detect activity is to look for stings on the fruit, and these are easiest to spot on cherry peppers.

Pepper maggot larva (center) and pupa (right) alongside a pepper seed (left). Photo: University of Kentucky

Pepper maggot flies are smaller than a house fly, and are bright yellow with three yellow stripes on the thorax, green eyes, and clear wings with a distinct banding pattern. The pest overwinters as pupae in the soil where last year's host plants were. Flies emerge in mid-July and aggregate in forested field edges to mate, then enter the field during the day to lay their eggs. Females insert eggs directly into immature pepper fruit and leave a small dimple, which is called an ovipositor sting or scar. Eggs hatch after about 10 days and the white maggots then tunnel inside the fruit to feed, especially in the placenta, causing soft spots on the wall of fruit and brown mines within. Maggots reach about ½ inch in length over a period of about two weeks. Maggots do not have a distinct head capsule; this distinguishes them from ECB larvae, which have brown head capsules. When pepper maggots are ready to pupate, they exit the fruit at the blossom end, leaving tiny round exit holes, usually in the end of August or in early-September. These holes allow for the entry of soft rot bacteria into the fruit. Sometimes the oval brown pupae can be found inside the fruit. Often damage is detected only because of premature ripening or decay of the fruit.

Pepper maggot oviposition scars.
Photo: OMAFRA.gov

Pepper Maggot Monitoring: It is effective but difficult to monitor for pepper maggot flies; to successfully capture the flies, you must place yellow sticky traps baited with a vial of 28% ammonium hydroxide 20 feet up in maple trees along hedgerows. A simpler way to monitor for fly activity is by scouting their preferred crops for ovisposition scars—the marks left by egg-laying females. The flies prefer to lay eggs in the small (1-3 cm in diameter) round fruit of cherry peppers, and when these are planted in border rows around a pepper crop they work very well as indicator plants. Oviposition scars appear as depressions or scars and are easy to find on these small, round fruit. By timing insecticide applications with the first occurrence of the stings on the indicator plants' fruit, damage to the main crop can be avoided with minimal spraying. If cherry peppers are not part of your crop mix, look for stings on bell peppers—these are their second favorite type of pepper.

Pepper Maggot Threshold: Farms that have never had a problem with this pest generally do not need to be concerned; however, the range of this pest seems to be expanding. If a given farm has a history of pepper maggot activity, then it is recommended that an insecticide be applied as soon as flies are captured in sticky traps or stings are observed. Chemical controls need to target the adult fly because eggs are protected beneath the skin of the fruit and larvae are protected within the fruit itself. As soon as stings are observed on fruit or the first fly is trapped, make 2-3 insecticide applications, 10-14 days apart, with a material labeled for pepper maggot.

When the activity of ECB and pepper maggot fly overlap, use of Orthene at 8-10 day intervals for control of ECB will also provide control of pepper maggots. However, other selective insecticides for ECB will not control pepper maggot. Insecticides labeled for pepper maggot fly include alpha-cypermethrin, dimethoate, malathion, zeta-cypermethrin (e.g. Mustang), and spinosad (GF-120 Naturalyte). GF-120 Naturalyte is allowed for organic production. When using Naturalyte, a large spray droplet size of 4-6 mm is recommended to optimize the duration of this bait's attractiveness to the flies. See the Pepper Insect Management section of the New England Vegetable Management Guide for more details on using these products.

Pepper Maggot Cultural Practices: Since pepper maggot builds up on particular farms or fields rather than spreading out far and wide, you can make an impact on the population size on your farm over time by using cultural practices.

- Disc and plow pepper residue as soon as harvest is complete to kill larvae and pupae.
- Rotate peppers far from last year's crop.
- Control solanaceous weeds, especially horsenettle.
- Cover the pepper crop with insect netting during egg-laying (beginning in mid-/late- July).
- Remove infested and/or rotting fruit from field at each harvest and destroy (e.g. by feeding to pigs or chickens or burying deeply in a compost or cull pile). This will remove larvae and pupae from the field too.
- Use plastic mulch and/or weedmat as barrier to prevent larvae from reaching the soil to pupate. Instead, they will get cooked on the mulch or mat surface.

European corn borer (ECB) is a resident pest that has 2 generations per year in southern and central New England and 1 generation in northern New England. This pest prefers sweet corn but can cause damage on a wide range of crops, including bean, potato, garlic, and pepper. ECB generally does not become a pest in peppers until the appearance of the second generation in late-July or early-August (1400 GDD base 50°F). See Table 2 in Pest Alerts for current GDDs across the state. The severity of ECB damage in peppers varies throughout the state. Some farms—typically in areas where farming is less dense and ECB populations have not built up— do not see much damage from this pest. In the Connecticut River Valley and in southeastern MA, an unsprayed pepper field is likely to have anywhere from 10 to 100% of the fruit infested. In some cases, it seems that sweet corn—which ECB prefer over peppers—helps to draw ECB away; in other cases, presence of sweet corn near peppers provides no benefit at all.

ECB Life Cycle and Damage: Larvae overwinter in stalks of corn and other host plants and pupate in the spring. Adult moths emerge in late-May or early-June and mate in weedy or grassy areas. The moths are about ¾" long, light brown in color with lighter bands on the wings. Females lay masses of flat, white eggs 3 to 7 days after they emergence (depending on temperature). Eggs hatch in about 5 to 7 days (100 GDDs base 50°F). After the eggs hatch, the newly emerged larvae feed on leaf tissue for a short period and then bore into stems or fruit. ECB larvae often burrow into the fruit beneath the calyx. In addition to this direct injury, ECB damage also causes premature fruit ripening. Boring holes also allow for the entry of pathogens into the fruit, which can cause fruit rot. Controlling ECB larvae before they reach the pepper fruit is essential to effectively managing this pest. Larvae vary in color from light-gray to pink but always have small, dark spots on each body segment and brown head capsules.

Frass surrounding ECB entry holes in pepper calyx. Photo: Ontario Crop IPM

ECB Thresholds and Control: ECB emergence is monitored using pheromone traps that attract male moths. Traps at sites across the state are checked weekly and moth counts are reported in the sweet corn section of Pest Alerts. New York

and Maine also publish weekly trap counts. Spray timing depends on trap counts. When the crop is fruiting, make the first application 1 week after 7+ moths per week are trapped. Discontinue sprays 1 week after moth counts drop below 21 moths per week. The spray interval depends on the residual period of the insecticide used as well as weather conditions and pest pressure. Use shorter spray intervals during peak flights and when trap captures exceed 150 moths per trap weekly. Choose selective/microbial products such as *Bacillus thuringiensis* aizawai or kurstaki strains whenever possible to preserve beneficials and reduce the chance of aphid outbreaks, which can be caused when pyrethroids are used and natural enemies are killed.For other chemical control options see the pepper insect section of the New England Vegetable Management Guide.

Clockwise from top left: European corn borer adult, egg mass, and larva.
Photos: D. Ferro; J. Kalisch Univ. of Nebraska Lincoln; and Clemson University, USDA, Bugwood.net

Using *Trichogramma* wasps for biological control of ECB in pepper. Sweet corn is not the only crop where ECB can be controlled with the parasitic wasp, *Trichogramma ostriniae*. ECB will invade pepper fruits that are > ½ inch across, and *T. ostriniae* attacks only the egg stage, so timing is critical. We recommend that you begin releases the week that flight begins and continue weekly releases for a total of 4 weeks. Release 90,000 to 120,000 wasps per acre and spread the cards out throughout your pepper block. Higher rates are needed in peppers compared to sweet corn because the tolerance for damage is virtually zero and ECB larvae attack the fruit directly. Four releases are needed because the egg-laying period for the second generation is longer than for the first generation of ECB. Fortunately, peppers are also a higher value crop and worth the extra cost. After four releases, *Trichogramma* will have reproduced in the field and biocontrol should continue. Wasps can be ordered from IPM Laboratories, at www.ipmlabs.com or by phone, 315-497-2063. Wasps can also be used in combination with insecticides, but choose a selective material (see above) that will not kill wasps.

--Written by R. Hazzard, UMass Extension. Reviewed 2021

News

Let us know how you use the New England Vegetable Management Guide!

Do you use the New England Vegetable Management Guide as a resource? If so, we want to hear from you!

The authors of the New England Vegetable Management Guide want to learn more about how the guide is used, so that we can make it as useful as possible. While we are revising the guide, we have designed a short survey to better understand what YOU value in the guide. Please consider taking 5 minutes to provide your feedback and suggestions here: https://unh.az1.qualtrics.com/jfe/form/SV_9Ag68WJ1uyjreE6.

MDAR Seeks Responses for the Specialty Crop Block Grant Program – Round II

The purpose of the Specialty Crop Block Grant Program (SCBGP) is to enhance the competitiveness of specialty crops. Specialty crops are defined as "fruits, vegetables, tree nuts, dried fruits, horticulture, and nursery crops (including floriculture)." Additional specialty crop categories and details here. For details and how to apply, click here.

Applications are due by Tuesday, August 10, 2021 at 5:00pm.

Events

In-Person UMass Summer Field Day

When: Tuesday, July 27, 2021, 3-7pm. Dinner at 7pm (Rain date: Thursday July 29)

Where: UMass Crop & Livestock Research & Education Farm, 91 River Rd, South Deerfield, MA

Registration: Free! Pre-registration required. Click here to register for this event.

Come to see the newly purchased no-till transplanter in action. Also, learn about several new innovative research projects on a wide range of topics including soil health, cover crop termination strategies, summer and fall cover crop mixtures, vegetables, forages, and more. The field day includes a four-hour tour by the Vegetable and Crops, Dairy, Livestock extension teams. Dinner will be provided at the end of the tours. More details about the projects, researchers, and tours will be available in early July.

Spanish language interpretation will be available. You can request a headset at registration.

This event will be made possible by UMass Center for Agriculture, Food, and the Environment, MDAR, Northeas-SARE, the UMass Stockbridge School of Agriculture, and American Farmland Trust.

UMass Vegetable Program and CRAFT Field Walk – Small Farm, Stow, MA

When: Wednesday, July 28, 4-6pm. If there are bad thunderstorms, we will cancel this event, and if it's raining we'll cancel the potluck.

Where: Small Farm, 184 Gleasondale Rd, Stow, MA 01775. Wednesday is a CSA pickup day for us, so please drive through the gravel parking lot and parallel park along the farm road on the right hand side. There will be signs. If you're coming in late and the lot is mostly empty, feel free to park in the lot.

Get ready to nerd out on bugs! We will talk about how we use UMass as a resource at Small Farm, for preventing and identifying pests and diseases, as well as deciding when and how to take action. Sue Scheufele will lead us on a brassica scouting walk, showing us how to scout effectively. Then we'll head to our tomato and cucumber high tunnels where we'll do some disease identification and learn about pollination and beneficial insects from UMass's Extension latest addition, Hannah Whitehead.

There will be a potluck following the field walk, from 6-7:30. If you're bringing a dish, please list the ingredients (we'll have supplies for this). Bring a lawnchair/picnic blanket if you like. If it's raining, we'll cancel the potluck.

COVID requirements: Please wear a mask if you are not vaccinated.

Registration: Please register for this event here: https://forms.gle/VPvRo559866QynFH6. If you forget to sign up, please come anyway!

UMass Twilight Meeting - Cover Crop Strategies for Vegetable Farms

When: Wednesday, August 11, 2021 - 4:00pm to 6:00pm

Where: Appleton Farms, 219 County Rd., Ipswich, MA 01938

Registration: Click here to register for this event.

Join UMass Extension for this in-person twilight meeting all about making the best use of cover crops for weed control, soil health and fertility, and attracting beneficial insects.

- **Appleton's farm manager, Andrew Lawson**, will discuss the farm's current cover cropping practices and demonstrate their high-speed, shallow tillage disc cultivator.
- **UMaine Extension Educator and Researcher, Jason Lilley**, will talk about planning cover crops into vegetable rotations, species selection considerations, interseeding into late-season crops, and more.
- **UMass Vegetable Team Educator, Hannah Whitehead** will discuss cover crops and beneficial insects.
- A light supper will be served. No cost to attend but please RSVP so we can get an accurate headcount.

Questions? Contact Lisa McKeag at (413) 545-1051 or lmckeag@umass.edu

Successful Value Added Food Product Development: Managing Food Quality and Safety

Are you an entrepreneur developing new and exciting products? Do you have questions about ensuring the safety of your product? If so, this is the program for you! This course is a program designed specifically to address product development and food safety issues faced by small processors. Throughout the course, we will introduce the food science basics, important considerations when developing a new food product, share key elements required for product labeling, and provide an overview of key regulatory requirements for small and emerging food businesses, such as entrepreneurs and local food processors.

Upcoming Sessions and Registration link:

- Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety- WVU: Mondays, 5:30-7:30pm, July 12 to August 16
- Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety- FCCDC: Tuesday, August 10 and Thursday, August 12, 9am-4pm
- Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety- NFU and UoA: Tuesday, August 31, Wednesday, September 1, and Thursday, September 2, 10am-2pm

UNH North Country Lunch and Learn

UNH Extension is offering this online series, open to all but focused on growing vegetables commercially. So, grab your lunch and let's learn!

This event is free, but registration is required.

- **August 4, 12-1pm:** Brussels Sprouts: Growing and Storage

Registration: Click here to register for these workshops.

Questions? Contact nicholas.rowley@unh.edu or heather.bryant@unh.edu or call 603-788-4961 ext. 207

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Vegetable Notes. Genevieve Higgins, Lisa McKeag, Susan Scheufele, Hannah Whitehead co-editors. All photos in this publication are credited to the UMass Extension Vegetable Program unless otherwise noted.

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