UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Crop conditions

The first of the sweet corn is being harvested now, garlic harvest is starting, tunnel tomato harvest is underway, and melons are sizing up. Irrigation and cultivation are the orders of the day. Still struggling with weed control? Come to our Organic Weed Management Twilight Meeting on July 24th, 4-7pm at Langwater Farm in North Easton, MA. See the Events section of this issue for registration information.

One possible upside to the fairly dry weather we have been experiencing is that disease pressure is low. We have not seen many of the common fungal diseases on our farm visits (e.g. early blight of tomatoes, anthracnose and scab in cucurbits, alternaria leaf spot in brassicas, etc.), since these pathogens thrive in cooler and wetter conditions. That said, bacterial diseases may be worse in hot humid weather, so keep an eye out for bacterial diseases in tomato and pepper like spot and speck and canker, and bacterial wilts. We even saw bacterial soft rot, causing winter squash plants to quickly yellow and collapse this week. The hot weather has encouraged the heat loving insects (thrips, flea beetles, most aphids, etc.) Yet, one farm in the Berkshires is free of flea beetles! They have made use of ProtekNet insect netting all season long, and currently are growing only waxy brassicas, which are less preferable to flea beetles.

UMass Crop and Animal Research and Education Center (fields to the left) with surrounding landscape, South Deerfield, MA. Photo: K. Campbell-Nelson

Many farms have had a bumper crop of early broccoli this year, but later plantings may be affected by last week's temperatures well into the 90's. Growers are wondering, "Will the broccoli heads develop?" and "Was that last cultivation pass or spray worthwhile?" Read more about managing heat stress (and caterpillars) in broccoli in this issue. Meanwhile, crews are out planting fall brassicas, so if this succession doesn't succeed, there will be another.

Pest alerts

Brassicas:

Brassica caterpillars: Imported cabbageworm and diamondback moth eggs and caterpillars are being found throughout MA--brassicas forming heads are particularly susceptible. Treat these crops at a 15% infestation. Pupae of the native wasp *Cotesia rubecula,* which parasitizes ICW are also being found, but diamondback moths are not affect by this parasitoid. See article this issue for more on these caterpillars and their parasitoids.

Basil:

Basil Downy Mildew was reported last week on the variety "Eleanora" in Franklin Co., MA and this week in Hampshire Co., MA.

Beans:

Mexican Bean Beetle adults, larvae, and eggs were spotted in Worcester Co., MA this week. Now is the time to scout for overwintered adults, eggs, and larvae in foliage, especially on undersides of leaves. When eggs first begin to hatch call NJ Dept of Ag to order the parasitic wasp *Pediobius foveolatus*. Contact Alexandra Villiard at 609-530-0309 or Alexandra.Villiard@ag.state.nj.us

Bean Anthracnose was diagnosed at the UMass Plant Diagnostic Lab on the seeds of the variety 'Gold of Bacau'. The grower who submitted the seed experimented with a hot water seed treatment protocol which was to soak seeds at 64° to 72°F for 15 hours and then soak at 117°F for 25 minutes. The grower reports good germination of the treated seed, and so far no symptoms of anthracnose, which include dark lesions on veins or spotting on the leaf surface. Last year he saw symptoms on this variety early on. Weather conditions have not been favorable for disease development, so we are not sure yet if anthracnose will appear or not. Symptoms will appear 4-9 days after a prolonged wet period.

Cucurbits:

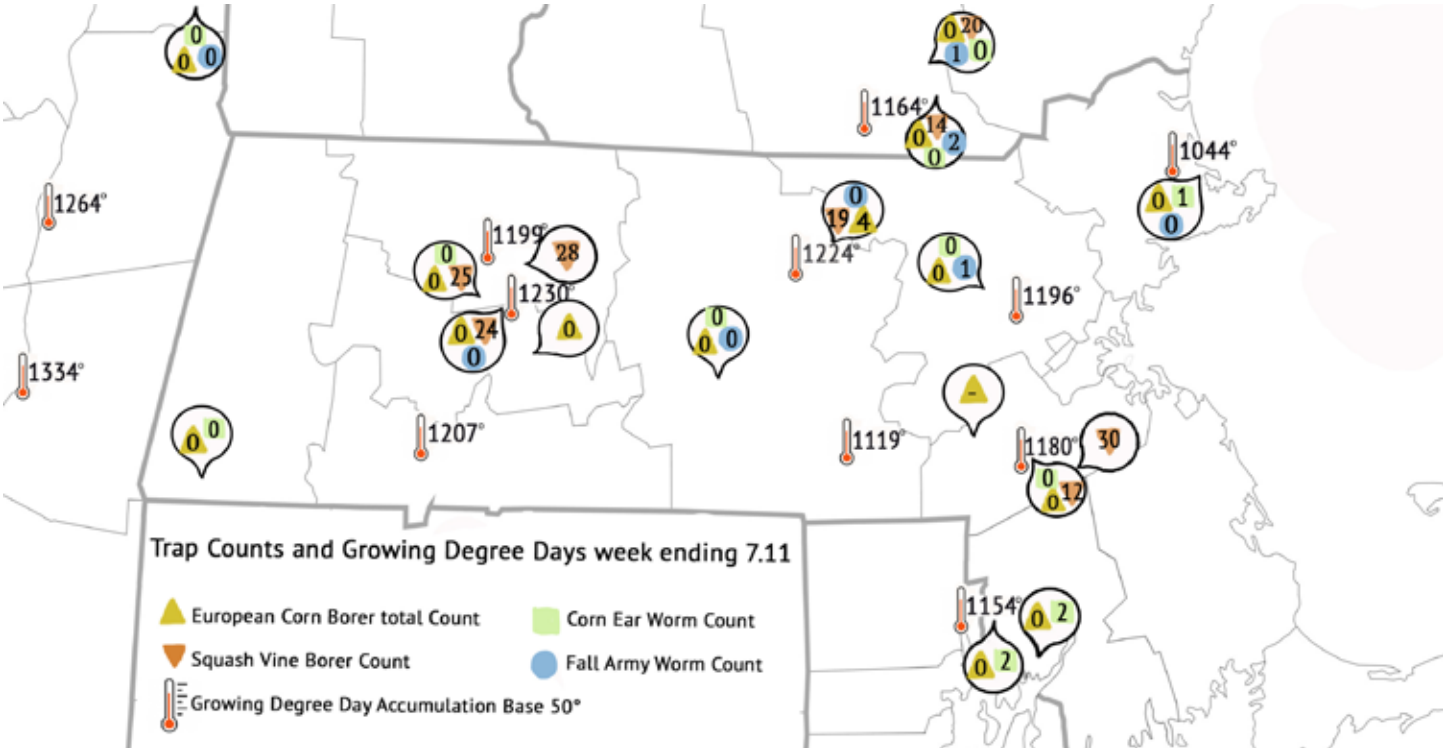
Squash bug eggs, adults, and nymphs are present now across MA. When targeting nymphs, the threshold is more than one egg mass per plant, and when nymphs are first seen. When targeting adults, the threshold is 1 adult per 2 or more plants in susceptible crops, or 1 adult per plant in less susceptible crops such as watermelon.

Squash vine borer **e**ggs were found last week in Bristol Co., MA and this week in Hampshire Co., MA. Trap counts are also increasing (see map below). Some clever growers are using duct tape to remove eggs from stems instead of spraying. They must have small plantings. The most susceptible crops are thick stemmed cucurbits such as summer squash, zucchini, giant pumpkin, pumpkins, delicata, and kabocha. New Hampshire Cooperative Extension is posting their SVB monitoring information online here: UNH SVB Weekly Scouting Reports.

Two-spotted spider mite was found in a localized infestation on greenhouse cucumbers in Berkshire Co., MA this week. Last year, a grower with this pest was successful at controlling them with several releases of the predatory mite *Phytosieulus persimilis.*

Solanaceous:

Blossom end rot **(BER)** is being reported frequently, especially in high tunnels. A few weeks ago we published this



foliar fertilization article by Gordon Johnson at the University of Delaware. He wrote: "Foliar calcium (Ca) is often recommended, but because it moves very little, it must be applied at proper growth stages to be effective. For example, for reducing blossom end rot in tomato or pepper fruits, foliar calcium must be applied when fruits are very small. Best sources for foliar calcium are calcium nitrate (10-15 lbs/a), calcium chloride (5-8 lbs/a) and some chelated Ca products (manufacturers recommendations)." Other causes of BER include irregular watering, rapid plant growth, low potassium and calcium, excess magnesium and nitrogen, high salinity, root damage, and high relative humidity.

Sweet Corn:

New York and New Hampshire Extensions both report sweetcorn pest data weekly and keep up to date records. Click on the link for each state to see their information.

European corn borer: We are currently between generations for this pest in MA. The second generation flight will begin at 1400 GDD base 50ºF. While we are not currently catching any ECB moths the traps are often full of gypsy moths (photo), which are not a pest of corn.

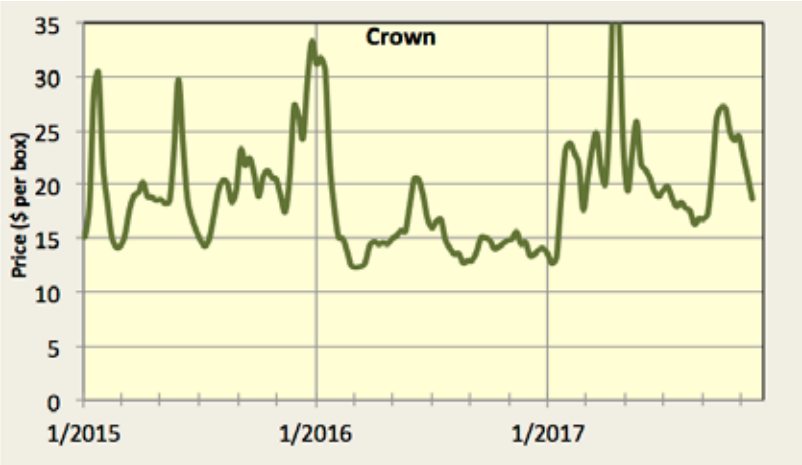
Corn earworm: Not many storms have blown into our region lately, so, CEW trap counts have remained low, luckily. Two locations in Southeastern MA are on a 6-day spray rotation for CEW (map). All other locations do not require a spray.

Western bean cutworm: Our first catch this year was in Franklin Co., MA. This was likely an overwintering population because the moths found in traps were in good condition (not tattered from a long flight). WBC has just begun to emerge and arrive in New York state as well. Most damage from WBC is seen in field corn, not sweet corn. They lay eggs on pre-tasseling corn, and most early sweet corn has already tasseled.

Sap Beetle: While caterpillar pests have not been much of a problem yet this season in sweet corn, some growers are treating their corn for sap beetle larvae which peak in July. Varieties with well covered tips are more protected. Do not leave infested blocks standing; mow aggressively to chop ears as soon as the block is finished. Deep plowing may be necessary after harvest if infestations are high, with the aim of burying ears at least 4" deep. Research in Maryland showed that ear infestation begins just after silk emerges and that 1 or 2 applications made 3 and 6 to 7 days after silking begins is more effective than later or more frequent applications.

MANAGING HEAT-RELATED DISORDERS IN BRASSICAS

Achieving 500-600 boxes per acre of broccoli through the hottest part of the summer is a tricky proposition, and while there isn't a silver bullet that will ensure a perfect crop, there are ways that you can mitigate your risk and ensure the best possible broccoli crop all summer long. Plant too early, and your broccoli or cauliflower may suffer from buttoning due to cold temperatures; have head formation occur during a heatwave, and you may suffer from heat related disorders. However, there is a benefit to having a crop like broccoli year round if selling to a wholesale market. There are many spikes in the price, and having fields to harvest year-round will give you the opportunity to capture a good price (Fig. below).



Terminal market prices of broccoli crowns in the East. Mean value for all Eastern terminal markets for crown-cut broccoli. Source: USDA AMS Market News

To avoid the risks of heat related disorders, many growers focus their brassica production on the cooler ends of the season. They have been harvesting early spring brassicas since May, are now cutting spring cabbage and broccoli, and are starting to plant their fall brassica crops. Some growers are managing to produce summer brassicas successfully, with head formation beginning now, but this can be challenging. As our first heat wave of the summer hit New England this past week, we thought now would be a good time to discuss management of heat related disorders in brassicas. Heat and moisture stress reduce the crops' ability to take up and translocate nutrients within the plant, ultimately leading to a majority of the disorders discussed below. Head rot, brown beading, and tip burn are all caused by calcium (Ca) deficiencies in

the plant, while hollow stem is caused by a boron (B) deficiency.

Broccoli head rot.

Head Rot and Brown Beading: Problems with Ca uptake combined with rapid growth can result in head rot or brown beading in broccoli, even when soil Ca levels are high. Head rot results from bacteria breaking down the tissues under wet conditions, and brown beading results from individual flower buds aborting under dry conditions. Excess nitrogen and extended periods of wet or dry conditions during warm temperatures give rise to rapid plant growth while Ca uptake is diminished due to poor transpiration rates in the plants.

Research done by Thomas Bjorkman at Cornell University, using the cultivar 'Galaxy', showed that the critical period for heat sensitivity in broccoli only lasts for roughly ten days. This 'window' of sensitivity corresponds to the time when the growing tip shifts from vegetative growth to flower bud initiation. This period of about 10 days begins just before a tiny crown is visible in the center of the plant. Temperatures above 35°C (95°F) for more than four days during that period causes uneven bud development, resulting in heads that are uneven and poorly shaped, leading to head rot and brown beading. Other references suggest that temperatures above 85°F can cause heat injury.

Brown beading in broccoli.

Management: Uneven or inadequate soil moisture also exacerbates heat stress. Drip irrigation is helpful for supplying water on a steady basis without increasing the risk of water sitting on the head. When individual buds or areas of the head are killed by heat stress, this allows entry of pathogens. Uneven heads also allow water to remain longer on the surface of the head, which increases the likelihood of disease development. Mixing varieties based on rate of maturity offers growers another practical defense against either head rot or brown beading, because it distributes the critical period for heat sensitivity across a range of weather conditions. Select a later-maturing cultivar to be harvested along with your regular cultivar for the part of the growing season when problems have typically occurred. Check with your seed supplier regarding heat tolerant varieties. 'Emerald Crown' (Seedway), 'Green Magic' (Johnny's Selected Seeds, Harris), and 'Belstar' (JSS, High Mowing Seeds) are standard varieties reported to have good heat stress tolerance in New England. The Eastern Broccoli Project, led by Thomas Bjorkman found that "in the most stressful environments, four varieties stood out from the rest with respect to bead uniformity and dome structure: DuraPak 19, Lieutenant, DuraPak 16, and Tradition."

Tip burn has been generally recognized as a calcium (Ca) disorder, though it usually results from high temperatures and uneven rainfall/irrigation preventing the plant from taking up adequate Ca, rather than from a deficiency in the soil. Tipburn and internal browning affect many brassicas and both head and leaf lettuce. Calcium (Ca) deficiencies show up on young, growing tissues. In cabbage, margins of inner leaves turn brown, beginning at the hydathodes (structures in the leaf tip or margin that excrete excess water), and later desiccate to become thin and papery at the margin or over large portions of the leaf. The affected tissue may turn dark brown to black, occasionally being invaded by secondary bacteria that cause a watery soft rot. In cauliflower, internal leaves turn brown and fold over the developing curds. When secondary microorganisms attack these leaves, they become a mushy smear over the curd and make the head unmarketable. On a daily basis, Ca moves with the transpiration stream to the outside leafy parts of the plant, which are actively transpiring on sunny days. At night, especially when dew forms, transpiration is reduced and water movement generated by the roots is directed to the inner part of the head. However, on warm, dry nights the outer leaves continue to transpire, and Ca is diverted away from the head. Once Ca is fixed by the outer leaves, it cannot be translocated to the interior of the head.

Internal tip burn in cabbage.

Environmental conditions that favor rapid plant growth favor tipburn. Abundant soil moisture promotes rapid growth, while excess moisture reduces soil oxygen levels, which in turn reduces Ca uptake and movement. A warm dry spell after

a period of abundant moisture may aggravate the disorder. Drought or root damage such as early season cabbage maggot feeding also stress the root system and can impair the plant's ability to take up Ca and translocate it. Excess nitrogen (N) encourages rapid growth, and also results in large outer leaves that accumulate Ca at the expense of young inner leaves. Wide spacing also encourages large outer leaves and rapid growth.

Use of urea, ammonium nitrate, or calcium ammonium nitrate fertilizer can aggravate Ca problems, because ammonium cations out-compete Ca for uptake in the plant. Calcium nitrate is more expensive, but the N is all in the nitrate anion form which will give brassicas the needed N fertility but will not compete with Ca for uptake. Note that when applying Ca nitrate through a drip system it is important to use greenhouse grade material rather than field grade to avoid clogging the system. Excess potassium cations also inhibit uptake of Ca, while excess phosphorus binds with Ca in the soil, reducing uptake of both nutrients. Some of our soils have excessively high phosphorus relative to potassium.

Management: Factors that promote rapid plant growth should be avoided, because rapid growth puts a high demand for Ca on the tissues. Maintenance of optimum but not excessive fertility (including N) is important. Maintaining a phosphorous to potassium ratio of 1:1 should help to minimize the incidence of tipburn. Irrigation may be necessary to maintain steady and optimum levels of soil moisture. Addition of high levels of Ca to the soil and foliar applications do not seem to alleviate the problem. Close plant spacing and prompt harvesting of crops when mature are beneficial practices. Internal symptoms grow worse as heads become larger and more mature. Avoid aggressive cultivation which can damage roots.

Cultivars that grow less vigorously are less prone to this disorder. Resistant cultivars are available for some crops - check your seed suppliers for their recommendations. Growers reported that the cabbage cultivars Green Cup and Bronco had worse symptoms than other cultivars when the problem occurred in 2004 and 2005.

Hollow Stem: Heat and rapid growing conditions exacerbate the effects of boron deficiency leading to hollow stem in heading crops which is often not noticeable until harvest. Chlorotic younger leaves or rosette die-back can be a sign of B deficiency and hollow stem. Hollow stem is worsened by pH greater than 7. Excess moisture leaches B out of the soil and low moisture inhibits soluble B uptake and poor root development. Excess Ca, K, or Zn have also been shown to outcompete B in plant uptake. Other causes include excess nitrogen fertilizer, imbalance of nitrogen and boron, or rapid growth after head initiation. High P levels in soil have been shown to increase B uptake. There are cultivar differences in boron sensitivity.

Boron deficiency in cauliflower

Management: Avoid sidedressing brassicas with nitrogen after head development begins. Broccoli, cabbage, cauliflower, turnip, and rutabaga are very sensitive to boron deficiency. The best method to apply a small amount of boron is as an additive to the fertilizer or diluted in a water spray applied to soil before final field preparation. For example, if the level of boron in the soil is low (below 3ppm), apply 3 lb of boron (15 lb Solubor, or 30 lb Borax)/A before planting broccoli and cauliflower, and 2 lb/A for cabbage. Conventional fertilizers can be purchased with added boron. Other boron products include granular Boron 15% and soluble Borosol 10%.

-- UMass Vegetable Program, updated 2018

WATCH FOR PEPPER MAGGOT FLY

Pepper maggot fly. Photo: bugguide.net

Pepper maggot (*Zonosemata electa*) adults emerge in mid to late July and are active for several weeks, so this is the time to watch for their activity. One grower in Bristol Co., MA reported oviposition marks on his cherry bomb trap crop this week, so we know the fly is now active in southeastern MA. Larval damage is confined to solanaceous plants, including ground cherry, horse nettle, tomato, pepper, and eggplant. Pepper is the preferred host and green bell and cherry peppers are especially susceptible to pepper maggot fly damage.

The pepper maggot fly is found throughout eastern North America and in New England,

the range of pepper maggot has been creeping northward and now extends into southern NH and throughout Massachusetts. Pepper maggot fly activity is very localized, and varies by farm, by region, and by year. Many farms never have a problem with this pest. Some may have it and not realize it, because it is possible to confuse maggot damage with damage caused by European corn borer. 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 flies are smaller than a house fly, are bright yellow with three yellow stripes on the thorax, and have 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, aggregate in forested field edges to mate, and enter the field during the day to lay their eggs. Females insert eggs directly into immature pepper fruit and leave a small dimple—an ovipositor sting or scar. Eggs hatch after about 10 days and the white maggots then feed and tunnel inside the fruit, 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, and do not have a distinct head capsule. When they are ready to pupate, they exit 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 monitoring: It is possible to monitor for pepper maggot flies but it is much more complicated than placing yellow sticky cards in the field. To be successful, you must use ammonia baited sticky traps placed 20 feet up in maple trees along hedgerows. A simpler way to monitor for fly activity is by looking at their most preferred crops for the first signs of damage, the stings made by ovipositing flies. Maggots 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. The egg-laying stings 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 minimum 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.

Oviposition marks made by the pepper maggot fly. Photo: OMAFRA.gov

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 if flies have been captured in sticky traps or stings have been observed. Control options need to target the adult fly because eggs are deposited under the skin of the fruit and are hard to kill, as are the maggots which reside inside the pepper. If stings are observed on fruit, make two insecticide applications, 10-14 days apart, with a material labeled for pepper maggot.

When the activity of European corn borer 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 Dimethoate, Malathion, Mustang (zeta-cypermethrin), and GF-120 Naturalyte (spinosad). 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 New England Vegetable Management Guide for more details on using these products.

Cultural Practices: Since this pest is one that builds up on particular farms or fields rather than spreading out far and wide, you can make an impact on the population size over time by using cultural practices. The most important are:

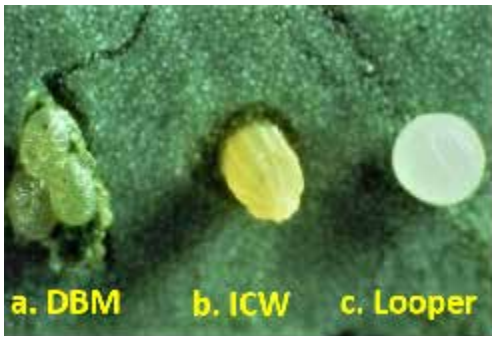
- Disc and plow pepper residue as soon as harvest is complete to try to kill larvae and pupae
- Rotate peppers far from last year's crop
- Remove solanaceous weed hosts, especially horsenettle
- Cover the pepper crop with Proteknet or other insect netting during egg-laying (end of July)
- Remove infested fruit from field—this will remove larvae and pupae from the field too.

- Use plastic mulch and/or weedmat to provide a barrier to prevent larvae from reaching the soil to pupate. Instead they will get cooked on the mulch or mat surface.

-R. Hazzard, University of Massachusetts with source material from J. Boucher, University of Connecticut Extension

CATERPILLARS IN BRASSICA CROPS

While you might think that it is the same caterpillar chewing all of those holes in your brassica crops, there are actually several different Lepidopteran species that might be causing the damage. Most growers are familiar with the white butterfly with little black spots in its forewings that can be seen all over the farm, but there are other less obvious culprits laying eggs out there too. Though they may all look similar, the four major brassica caterpillar pests have important distinctions among them that can affect your management decisions. They differ in size and feeding habits, as well as how susceptible they are to beneficial parasitoid insect species, and certain insecticides. Getting acquainted with the pests helps you to know what kind of damage to expect and what to look for when scouting for their different life stages and biocontrols. Feeding damage by any of these caterpillars can reduce yield and marketability of both leafy and heading crops.



The different eggs of common brassica caterpillar pests.
Photo ipm.ncsu.edu

From top, larvae of the Imported cabbageworm, diamondback moth, and cabbage looper.
Photos (top and middle) R. Ottens, bugwood.org and (bottom) UMass Extension

Imported cabbageworm (ICW), cabbage butterfly (*Pieris rapae*) is the very familiar white butterfly, which can be seen in the daytime fluttering around brassica fields. Each forewing has a dark border and one or two round black spots. Eggs are laid singly on the underside of leaves, standing upright (see b. in photo). They are slightly elongated, kind of bullet-shaped, about 1/8 inch in length, and initially pale white, but turning to yellow as they mature. The larva is gray-green, slightly fuzzy, and sluggish. Feeding and resting occur on the underside of leaves. The larvae can defoliate leafy plants and will feed in the head of cabbage or broccoli as they develop. Their feeding produces large amounts of frass, which may help you locate these otherwise well-camouflaged pests. The overwintering stage is the chrysalis (pupa), which is green or brown, smooth with three pointed ridges on its back. There are 3-4 generations per year.

Diamondback moth (DBM) (*Plutella xylostella*) adults are tiny (<1/2 inch), light brown, and rest with their wings folded together like a tent, with the ends of the wings turned slightly upward when seen from the side. They fly after dusk, so are not as readily apparent as ICW butterflies. They overwinter in crop residue, but may also enter the region by migrating from southern states. Eggs are laid singly or in small clusters (see a. in photo). Caterpillars go through four instars and are small (<1/2 inch when fully grown), light green, and appear segmented, with a forked end and pointed shape. When disturbed they wiggle vigorously and may drop off the plant on a string of silk. Feeding causes small, round holes and tends to be spread across the foliage and not necessarily concentrated in the head. Diamondback moth has shown a particular tendency to develop resistance to insecticides and careful selection and rotation of materials is required (see Insecticide Applications below).

Cabbage looper (*Trichoplusia ni*) usually does not survive the winter in New England and arrives in migratory flights from farther south. Generally populations of cabbage loopers are not high until late-July or August, though some years they are not found at all or earlier flights occur. Adult moths are mottled gray-brown, about 3/4 inch long, with a distinct round silver-white mark on each fore-wing. Since they fly at night, they are rarely seen unless monitored with pheromone traps. If you want to know when moths arrive, use a wing trap baited with *Trichoplusia ni* lure,

placed near the canopy. Eggs are round, pale green or yellow, and are laid singly underneath the foliage (see c. in photo). The cabbage looper caterpillar is light green, smooth, with wavy white or light yellow lines down the back and sides, and prolegs at the tip of the abdomen. Full-grown larvae reach 1 ½ to 2 inches. Cabbage loopers of any size will raise the middle of their body in a characteristic "loop" shape, as an inch worm would. Feeding tends to create ragged, large holes in foliage, on both frame leaves and heads. Cabbage looper also feeds in many non-brassicas including lettuce, celery, spinach, and chard so when they do arrive, scout those crops as well as brassicas.

Cross-striped cabbageworm (CSCW) (*Evergestis rimosalis*) is relatively new to New England. We first listed it in the New England Vegetable Management Guide around 2005, because it had become common in Connecticut. By 2012 it was found in Hampshire, Worcester and Norfolk Counties in MA. Its damage is similar to that of other caterpillars but it can be even more damaging if populations are high. One of the major differences between this insect and the other brassica caterpillars is that the eggs are laid in a group (see photo, right), and caterpillars feed in a group on one plant so that the leaves are quickly skeletonized.

A cluster of cross-striped cabbage-worm eggs

Cross-striped cabbageworm is closely related to European corn borer, and the adults are similar in shape and coloring – straw-colored with a little purple, and crossed by wavy lines. Since it flies at night, you will likely only notice the caterpillars and their damage. The clusters of 3 to 25 eggs are yellow, flattened, and attached to the lower leaf surfaces. The caterpillars are light bluish-grey on top and green underneath, with numerous black transverse bands across their backs and a yellow line down each side. Larvae grow to 3/4"-long in 2 to 3 weeks. There are 2-3 generations per year, but generally it's only in late summer that numbers reach damaging levels. Larvae can produce small holes in leaves until only veins remain, feed in terminal buds and sprouts, or burrow into heads. Plants with larvae are often completely skeletonized. Adjacent plants may be left undamaged.

Cross-striped cabbageworm larvae
Photo missouribotanicalgarden.org

Field Scouting and Management. It is especially important to check cabbage or broccoli plantings as they begin forming heads. Greens such as collards and kale should be scouted earlier, since all leaves are marketed. Check at least 25 randomly-selected plants throughout the field, looking for caterpillars or fresh feeding damage on the top or underside of leaves. Feeding damage can be found on the underside of leaves or in the center of the plant where heads are forming. Look for black or green frass and tiny feeding holes, clustered together. Often it is easier to spot the frass and feeding damage first, then find the caterpillar. Classify plants as infested (one or more caterpillars present) or non-infested, and calculate the percent of plants infested. In the Northeast, there is generally no need to treat young plants unless weather conditions delay plant development and at least 35% of them are infested with any of these pests. Treat heading crops between the start of heading and harvest if 15-20% or more of the plants are infested. The most critical time to scout and apply controls is just prior to head formation. For leafy crops like kale and collards where all leaves are marketed a 10-15% threshold should be used. Because cross-striped cabbage worm can be so destructive, a lower threshold should be used – treat when 5% of plants are infested with this pest.

Insecticide applications. Use at least 50 gal spray material/A; higher volumes provide better coverage. Better coverage of lower leaf surfaces can also be achieved by using drop nozzles. Use a spreader-sticker. It is important to use selective insecticides rather than broad-spectrum materials to protect beneficial insects that parasitize imported cabbageworm and diamondback moth larvae as well as keep aphids under control, and eat insect eggs and other small caterpillars. Selective products often are most effective when consumed with foliage so coverage is important. Effective, selective insecticides include:

- diamides (Group 28) including chlorantraniliprole (**Coragen**, 3 dh, REI 4h, Bee toxicity: L)
- spinosyns (Group 5) including spinetoram (**Radiant,** 1 dh, REI 4h, Bee toxicity: M) and spinosad (**Entrust**^{OG},1 dh, REI 4h, Bee toxicity: M) - also effective against flea beetles and onion thrips

- *Bacillus thuringiensis* (Group 11) products including *Bt aizawi* (**XenTari**[OG] , 0 dh, REI 4h, Bee toxicity: L) and Bt kurstaki (such as **Dipel DF**[OG] and many other products, 0 dh, REI 4h, Bee toxicity: L) – these materials will ONLY affect caterpillars

Diamondback moth has become resistant to many synthetic and microbial insecticides. Even if you are getting excellent control of this pest with the materials you are currently using, you should alternate between effective materials to retard development of resistance. Newer materials and the aizawai strain of *Bacillus thuringiensis* (found in the product XenTari) will usually provide better control of resistant DBM than older products. Use transplants grown in New England to avoid importing DBM that have already developed resistance to one or more classes of insecticides. See the cabbage/insect control section of the New England Vegetable Management Guide for additional synthetic and naturally derived products and more details.

Larva of Cotesia rubecula *parasitoid emerged from ICW*

Cultural and Biological controls. Incorporate crop residues shortly after harvest to reduce movement to successive plantings and reduce overwintering populations. Populations are suppressed by a wide range of natural enemies. There are several species of wasps that are important parasitoids of brassica caterpillars. Diamondback moth is parasitized by the ichneumon wasp, *Diadegma insulare*, among others. *D. insulare* occurs naturally in Eastern North America. Wasp females require sources of nectar to be effective DBM parasitoids, so maintain wildflower stands near brassica fields. The braconid wasps, *Cotesia rubecula* and *Cotesia glomeratus* are both established in New England and parasitize imported cabbageworm larvae. You may see their small white cocoons on brassica leaves either singly (*C. rubecula*) or in clusters (*C. glomeratus*).

Cotesia glomeratus cocoon cluster W. Cranshaw, Colorado State University, Bugwood.org

The chalcid wasp, *Trichogramma brassicae*, will lay its eggs in many species of caterpillar, including all of the brassica pests above (as well as non-target caterpillars, so be cautious if you *are* maintaining wildflowers that might attract endangered moths or butterflies). These wasps are not found in New England, but can be purchased from several biological control companies for release in brassica fields. The wasps arrive as pre-parasitized caterpillar eggs that are glued to cards that can be distributed throughout the crop. Each card costs around $16-$20 and contains about 100,000 wasps, which is enough for up to 1 acre. According to one source of *T. brassicae* wasps, IPM Labs Inc., some growers will release one card per acre per week for about 4 weeks, while others will release every week for the life of the crop, and will release the wasps in lieu of using any kind of pesticide. These biological controls are compatible with many selective and lower impact sprays (Bt, oils, soaps) used for control of caterpillars, particularly since the wasps are protected from sprays for longer than they are vulnerable, as much of the time they are unreachable inside of their host eggs. Another source, Evergreen Growers Supply, notes *Trichogramma* wasps are more effective against moth species that lay their eggs in clusters, so may be a good option if cross-striped cabbage worm has been a particular problem.

--R. Hazzard, S.B. Scheufele and L. McKeag

Events

Twilight Meeting Summer Series

This series of Twilight meetings is an opportunity to learn from fellow farmers and find out what's new in Extension research. A light meal will be provided at each program.

Organic Weed Management

Featuring: Langwater's Kevin O'Dwyer and their flame weeder and leaf mulching techniques. Invited presenters include: Katie Ghantous (UMass Vegetable Weed Technician) with a vinegar weed injector, on-farm trial and information on weed ecology; Sonja Birthisel (UMaine PhD candidate studying Weed Management) with results of her

research using occulation and solarization, and farmer Tyson Neukirch with his experiences using silage tarps in a reduced tillage system for weed management.

When: Tuesday, July 24th, 2018 from 4:00 pm to 7:00 pm

Where: Langwater Farm, 209 Washington St., North Easton, MA 02356

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/X9WLFYS

Click here to request special accommodations for this event.

UMass Extension Vegetable Program Research Tour and Round Table

Featuring: Sue Scheufele's research on cucurbit downy mildew resistance, pollinator protection in butternut squash, effects of different mulches on broccoli pests, and natural predators of cabbage aphid. Also, Madelaine Bartlett's research on corn genetics and the importance of genetics in crop development and improvement, Omid Zandvakili's research on lettuce nutrition, Kelly Allen's research on Fusarium wilt of basil, presentations on pollinators & agriculture and solar & agriculture, and more! Research presentations will be followed by dinner and a round table discussion.

When: Tuesday, August 14th, 2018 from 4:00 PM to 7:00 PM (Rain date: August 16th)

Where: UMass Crop and Animal Research and Education Farm, 89-91 River Rd., South Deerfield, MA 01373

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/X3JYR55

Click here to request special accommodations for this event.

Reduced Tillage and Transplanters for Vegetable Farmers

Featuring: Farmer Jim Ward and his reduced till vegetable cropping systems which he has practiced for over 10 years with the help of an Unverferth Deep Zone Tiller, Davidian Farm's two-row Monosem vacuum precision planter mounted with Dawn Biologic roller crimpers (first ones in the state!), the UMass Research Farm's grain drill and roller crimper, and Brookdale Fruit Farm's new line of no-till transplanters from Checchi-Magli. There will also be demonstrations on Soil Health with Maggie Payne, Soil Scientist at NRCS.

When: Tuesday, August 28th, 2018 from 4:00 PM to 7:00 PM

Where: Ward's Berry Farm, 614 S Main St., Sharon, MA 02067

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/XF8JQYD

Click here to request special accommodations for this event.

Respirator Train-the-Trainer Course for Farmers, Beekeepers, and Other Employees who Need to Use Respirators

UMass Extension is offering a series of Respirator Train-the-Trainer workshops in 2018. Farmers, beekeepers and other who need to wear respirators, required by pesticide labels, can benefit from the workshop. Participants will learn how the fit test a respirator and select, use, clean, maintain and replace respirators. All handlers must be trained under the EPA Worker Protection Standard (WPS) Respirator Requirement if they apply any pesticide that requires a respirator. Several organic approved (OMRI) pesticides and some miticides used by beekeepers require respirators.

The respirator train-the-trainer workshops are 2 hours long and will be held in Marlboro, Taunton, Hadley, and Marlborough. The registration fee is $30.00 per person. Participants will received a Certificate of Attendance, a check list for respirator training, and a fit test protocol. This is an hands on workshop. Bring your respirator or use one of ours.

There is one workshop left in this series.

When: Tuesday, June 19, 2018 from 1:15 PM to 3:45 PM

Where: Best Western Royal Plaza Hotel, 181 Boston Post Road West, Marlborough, MA 01752

REGISTER HERE: https://www.regonline.com/registration/Checkin.aspx?EventID=2267202

Click here to request special accommodations for this event.

THANK YOU TO OUR SPONSORS:

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