Supporting Fruit Production

OHIO FRUIT NEWS

Research and Recommendations from The Ohio State University

June 2019

Thrips on Strawberries

Celeste Welty

Strawberry fruit that have been injured by thrips are a dull or bronzed color, and are often small, hard, seedy, and fail to ripen. Thrips can cause uneven maturity of fruit. When severe, their injury can make the strawberry crop completely unmarketable.

Thrips are an occasional serious pest of strawberries. This means that in most years, they are not a problem, but in some years, they can be a big problem. One such year was 2018 for some growers in Ohio. As far as we understand the problem, the reason for variability from year to year has to do with weather systems. In some years, conditions are right that large numbers of small insects such as thrips and leafhoppers blow into Ohio from the southern USA during the time that strawberries are in bloom. In other years, this long-distance movement does not happen at all, or happens later, at a time when strawberries are no longer in bloom.

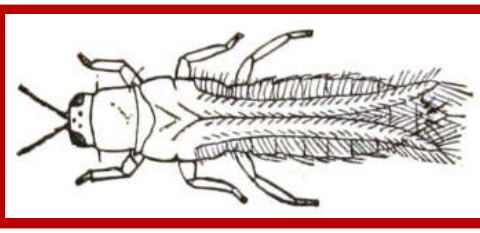
Thrips are small, slender, elongate, 'cigar-shaped' insects, about 1 mm (1/25 inch) long. They differ from other insects by having narrow strap-like wings that are fringed with hairs (Figure 1). The wings are usually folded lengthwise over the back when they are resting or feeding (Figure 2). They have asymmetrical mouthparts that have a well-developed left mandible and an underdeveloped right mandible. They feed by piercing plant cells by the mandible then sucking sap that oozes out of the punctured cells. Thrips generally prefere to feed on the flowers of the plant. They are found in flowers of many species of plants. Thrips are often overlooked due to their small size and their tendency to hide in protected places. When present at low density, thrips are often not harmful to plants.

The thrips species that infests outdoor strawberries is *Frankliniella tritici,* which has the official common name of 'flower thrips', but which is widely known as the 'eastern flower thrips'.

It looks quite similar to the western flower thrips, which is the species commonly found in greenhouses. The eastern flower thrips does not tolerate cold weather well, so does not survive winter well in places like Ohio. The adults are yellowish brown, and the larvae are whitish-yellow. The larvae are similar to the adults in shape but smaller and without wings. On strawberries, the infestation starts by adult thrips during bloom but then can continue during fruit set by adults and their offspring larvae. Thrips hide under the cap of the berry or in grooves around the seeds on the berry.

Figure 1. A thrip; note the narrow fringed wings and slender body shape.

Figure 2. A thrips in a typical position, with its wings folded over its back.



A key to thrips management is frequent monitoring, at least once per week. Growers should examine early flower clusters on early cultivars. In each of five to 10 areas of the field, five to 10 blossoms should be tapped into a white cup, or into a zip-top sandwich bag, which should then be examined for the dislodged thrips running around on the surface. Count the number of thrips found, then calculate the average number of thrips per blossom. A rough action threshold for treatment with insecticide is the presence of 2 or more thrips per blossom. Once fruit are ¼ inch in diameter, an action threshold is 0.5 thrips per fruit. If thrips are above threshold, the trickiest part of management is to avoid spraying insecticide that will harm pollinators. Insecticide should be applied pre-bloom or before 10% of the plants have open blossoms. If thrips are found above threshold on early cultivars, then a preventive spray can be made on the later cultivars before their flowers open, to avoid harming pollinators.

Insecticides used to control thrips on conventional strawberries are Radiant, Assail, Sivanto, and Apta, all of which have thrips listed as a target pest on their labels. Thrips are well controlled by Lorsban, Brigade, and Danitol, which are allowed for use on strawberries, but thrips are not listed as a target pest of the label of these three products. Note that Lorsban has a 21-day pre-harvest interval. Products for thrips control on organic strawberries are Entrust and azadirachtin products such as Neemix and Aza-Direct. Sprays targeted at tarnished plant bug or spittlebug, just before bloom, often do a good job of controlling thrips.

If a biological control approach is preferred, several kinds of natural enemies are available for purchase from commercial insectaries for thrips control: Orius (predatory flower bugs), and two species of predatory mites: *Amblyseius cucumeris* and *Ambylseius swirskii.* Biocontrol is not feasible to begin once the thrips population is large but can be planned in advance at locations that have a consistent problem with thrips.

Plasticulture Strawberry Fertilization and Sufficiency Ranges

Brad Bergefurd

With higher-than-normal rainfall amounts throughout Ohio this spring, I have been receiving a lot of questions regarding supplemental nitrogen, or just fertigation programs in general, for strawberry. I will recap some of the information we have been providing here.

For strawberry, when spring flowering and fruiting begins, plants should receive 6-to-7 pounds of N per week. A total application (both pre- and post-planting) of about 150 units of N per acre will be required each season, unless higher than normal rain events occur, in this case it could be as high as 200 pounds or more per acre.

Nitrogen applications should be made during this stage of plant development based on petiole nitrate nitrogen trends. Petiole nitrate nitrogen values should reach 3,000-4,000 ppm by early fruit-picking and then decline gradually to around 500 ppm toward the end of harvest. Research and experience has shown that a continued nitrogen feeding program all season long can extend the harvest season if temperatures remain moderate.

Sampling technique is very important in providing reliable results. The most recent mature trifoliate, including petioles, should be collected from throughout the field or variety. Samples should be taken from mother plants representing the average appearance of the crop.

Fifteen to 20 trifoliates and petioles are required for the analyses. Petioles should be stripped from the trifoliates and secured in a bundle with a rubber band or twist-tie. Both the trifoliates and petioles should be shipped to a plant analysis laboratory.

Currently, a total analysis and interpretation is provided on the trifoliates. Nitrate nitrogen is determined on the petioles and provides an additional evaluation of nitrogen status. In general, nitrate nitrogen concentration should never be below 500 ppm. Exceptions to this general rule would be during early winter dormancy (December-January) and after fruiting (July). During plant establishment (fall), petiole nitrate nitrogen should approach 1,500-2,000 ppm. During vegetative growth (early spring), nitrate nitrogen should increase to 3,000-4,000 ppm at early harvest, and then decline to 500 ppm by the end of fruiting. Excess nitrate nitrogen (over 10,000 ppm) may depress yield and will likely limit fruit quality.

Petiole nitrate nitrogen monitoring has not been perfected, however additional research is being done nationwide to fine-tune the sufficiency range to reflect not only optimum yield, but best shipping quality. Work is also being done to determine if this plant part can be used to evaluate the status of other important elements. Potassium, and perhaps other elements and their relationship to nitrogen, may be very important in optimizing fruit quality. Petiole nitrate nitrogen monitoring does play a significant role in managing strawberry nutrition.

Table 1. Sufficiency range[1] for fresh petiole sap[2] nitrogen (NO^3 - N) and potash (K^20- K) concentrations (ppm[2]) for strawberry plasticulture at specific stages.

Date - Stage	NO^3 Range	K^20 Range
mid-October	800-900	3,000-3,500
mid-November	600-800	3,000-3,500
Mid-March	600-800	2,500-3,500
Early-April (beginning of bloom)	300-500	2,000-2,500
5/10-6/? (harvest season)	200-500	1,800-2,500

[1]From Hochmuth, G. and Albregts, E. (1994). University of Florida Extension Circular 1141.

[2]Petiole sap readings with portable Cardy N and K ion meters, from spectrum technologies, Inc., 12010 S. Aero Dr., Plainfield, IL 60544.

A high yielding and quality strawberry crop begins with good fertility management

(Photo by Thom Harker)

Potassium (K) deficiency should be avoided, as this will negatively influence strawberry flavor. Boron, a critical element for fruit set, can also be foliar applied or fertigated as tissue and soil samples indicate. The best way to monitor the actual status of the various nutrients is through regular issue/petiole testing.

Table 2 lists the sufficiency ranges of various nutrients for strawberry plants in a plasticulture system.

Table 2. Sufficiency range[1] (dry weight basis) for nutrients in most recently matured whole leaves (tissue analysis - blade plus petiole) for strawberry plasticulture at mid-season.

Nutrient	Adequate Range (%)	Nutrient	Adequate range (ppm)
N	2.8-3.0	Fe	50-100
P	0.2-0.4	Mn	25-100
K	1.1-2.5	Zn	20-40
Ca	0.4-1.5	B	20-40
Mg	0.2-0.4	Cu	5-10
S	0.8-1.0	Mo	0.5-0.8

[1]From Hochmuth, G. and Albregts, E. (1994). University of Florida Extension Circular 1141.

Hand held Nitrate meters provide a quick test for plant nitrate concentrations.

Petioles are cut up and pressed with a hand held garlic press.

Plant sap is applied to the mirror on the meter.

An instant reading will appear on the meter.

All photos were taken by Thom Hacker.

Management for Different Berry Blights

Rachel Kaufman and
Melanie Lewis Ivey

Cane Blight of Blackberry

Phomposis twig blight of blueberry, cane blight of blackberry, and spur blight of raspberry all appear differently on canes and buds of the different small fruit but the good news is that they can all be managed the same. The three diseases are caused by 3 different fungi pathogens but act similarly with primary spore infections occurring in the spring on newly emerged buds , canes and wounded plant tissue. The infection then spreads within the cane throughout the growing season and then lays dormant during the winter. The following spring season, survival structures release a new set of spores from infected tissue to the new budding canes in the spring and the disease cycle repeats itself.

Pruning for these diseases should be done during the dormant season in early winter or early spring before new primocanes begin to emerge. All disease lesions should be removed from older fruiting floricanes and first-year primocanes. Limiting wounding to primocanes will decrease infection of these diseases. Pinching techniques can be used as an alternative to mechanical pruning on shorter canes to decrease the wound severity and the healing time. Increasing air flow within the berry patches and limiting excess nitrogen through plant tissue testing will also help to decrease the disease prevalence.

In severe cases, chemical control can be used on diseased plants. Products such as CaptEvate 68WG, Pristine 38WG, and Tanos are labeled to control the disease within season. For additional recommendations, please refer to the Midwest Fruit Pest Management Guide (ag.purdue.edu/hla/hort/documents/id-465.pdf).

If you have seen these symptoms or others on your berries, you can submit a diagnostic sample digitally or physically to the Fruit Diagnostic Laboratory. All information can be found at our website, u.osu.edu/fruitpathology/diagnostics/. You can also e-mail Melanie Lewis Ivey at ivey.14@osu.edu with additional questions.

Spur Blight of Raspberry

Phompsis Twig Blight of Blueberry

Current Insect Activity

Celeste Welty

Oriental fruit moth (OFM) has been active in apples and peaches in central Ohio since 4/17/2019, as detected by pheromone traps in our research orchard in Columbus; the degree-day model showed that the optimal date for the first spray to control OFM was 4/30/2019. In Wayne County this year, OFM was first detected on 4/22/2019. The target date for treatment for the next generation of OFM in Columbus is predicted to be around 6/14.

Codling moth has been active in apples in central Ohio since 5/9/2019, as detected by pheromone traps in our research orchard in Columbus. The degree-day model for predicting egg hatch of codling moth can be used to show the optimal date for spraying based on predicted temperatures over the next 10 days. The model shows optimal dates for Columbus were around 5/16 (50-75 degree-days after biofix) for Rimon, around 5/20 (100-200 degree-days after biofix) for Intrepid or Confirm, around 5/22 (150-250 degree-days after biofix) for Altacor, Assail, Belay, Delegate or Exirel, and around 5/25/2019 (250 degree-days after biofix) for Imidan, Avaunt, pyrethroids, Cyd-X or Virosoft CP4. These target timings are summarized on page 32 of the Midwest Fruit Pest Management Guide 2019-2020 (ag.purdue.edu/hla/hort/documents/id-465.pdf). Details about how to track degree-days are shown in an information sheet (cpb-us-w2.wpmucdn.com/u.osu.edu/dist/1/8311/files/2014/12/Apple3_CodlingMothMgmt2017-20cxqpi.pdf).

San Jose scale adults are active in apples in central Ohio. A few scales were found in pheromone traps in Columbus on 5/1, and many were found on 5/8; we are using 5/5 as the biofix date for Columbus. We are now following temperature to predict when the crawlers will be active, which will be about 400 degree-days, base 51 degrees, after biofix; this is predicted to be 5/29 in Columbus.

Plum curculio is one of the most important pests that attacks apple and peach fruit at petal-fall. It is a pest that we typically do not monitor by trapping because a reliable trapping method has not been available. This year, I am trying a lure for plum curculio that I have not tried before. It is called 'plum essence', available from Great Lakes IPM. Recommendations on how to use this lure are sparse. The lure can be used in a tall pyramid trap next to a tree or in a circle trap attached to the main trunk of a tree. We are using pyramid traps because we have many of them that were previously used for stink bug monitoring. We placed a small boll-weevil trap on top of the pyramid as the collecting container, with the lure attached to the outside of the trap top. Although it is recommended to set up the trap at petal-fall, I set mine up earlier, at the pink bud stage, which was on 4/17/2019 in Columbus. I was surprised that we caught 10 plum curculio in one trap on the first night that the trap was deployed, and a total of 42 of them over the first 14 days, followed by 10 days with no catch.

Although control of codling moth and oriental fruit moth is the top priority for apple growers in late spring and early summer, early summer is also the time to pay attention to foliar pests. **Rosy apple aphid** in fruit clusters is best evaluated pre-bloom but can be evaluated post-bloom by counting the number of distorted clusters in middle zone of the canopy in a 1-minute search per tree in each of 10 trees per block. **Woolly apple aphid** infestation can be evaluated by scouting its presence or absence on pruning cuts and twigs in a one-minute search per tree in 10 trees per block. **Green apple aphid** and **potato leafhopper** on terminal shoots can be evaluated by scouting their presence or absence on each of the five endmost leaves on each of ten terminal shoots per tree in 10 trees per block; the presence of predatory insects such as lady beetles, lacewings, and Orius flower bugs should be noted at the same time. **European red mite** should be scouted for every one to two weeks, particularly in young orchards; see cpb-us-w2.wpmucdn.com/u.osu.edu/dist/1/8311/files/2014/12/AppleScoutMite-292fumw.pdf for the recommended procedure. **White apple leafhopper** and **spotted tentiform leafminer** are pests that can be scouted in late spring and early summer, but in the past few years they have been present in negligible levels in most orchards.

Brown marmorated stink bug has been active around buildings and landscape trees on warmer days for the past few weeks but not yet detected in our research orchards in Columbus. We have traps being set up in 35 sites around Ohio, which will give us information about when and where they become active. We will be surveying more orchards this year for presence of a beneficial parasitoid that attacks and kills stink bug eggs.

Insecticide Update for Fruit Crops

Celeste Welty

Magister SC Miticide from Gowan Company has been registered for a few years for use only on cherries and hops but since April 2019 it is registered for use on additional crops. Although it is called a miticide because it controls spider mites and rust mites, it also controls some insects (psyllids and whiteflies), and powdery mildew on some crops. The active ingredient is fenazaquin. It is in insecticide mode-of-action group 21A, the same group that contains Nexter, Portal, and Apta. Magister kills mite eggs by contact, and kills mite adults and immatures by contact and ingestion. For fungicidal activity, it is in FRAC group 39. Magister is highly toxic to bees, so care must be taken to not spray it on blooming crops or weeds. Tree fruit crops now on the label are pome fruit (7-day PHI) and stone fruit (3-day PHI). Small fruit crops now on the label are blueberries (7-day PHI), caneberries (7-day PHI), strawberries (1-day PHI), and grapes (7-day PHI). Hops also are on the label with a 7-day PHI. There is a limit of one application per year on each crop.

Apta from Nichino America contains tolfenpyrad as the active ingredient; in IRAC's mode-of-action group 21A (same as Magister, in paragraph above). Since February 2019, new crops on supplemental labels for Apta are strawberry and other low growing berries (1-day PHI), raspberries and other caneberries (1-day PHI), and blueberries and other bushberries (3-day PHI). At the lower end of its rate range, Apta controls leafhoppers and aphids. At the higher end of its rate range, Apta controls thrips, Lygus (tarnished plant bug), plum curculio, apple maggot, pear psylla, pear rust mite and other eriophyid mites, and leafrollers and some other caterpillars, and it suppresses spotted-wing Drosophila, codling moth, and stink bugs. Apta has been registered for use on stone fruit since 2014 and on pome fruit since 2018.

Exirel is now allowed on raspberries and other caneberries, as shown on a supplemental label from November 2018. Use on caneberries is with a 1-day pre-harvest interval, for control of spotted-wing Drosophila and adult root weevils. Exirel is from FMC, contains cyantraniliprole as the active ingredient, in IRAC group 28.

Versys is a new insecticide product for knockdown and residual control of aphids on pome fruit and stone fruit, both with a 7-day PHI. It is made by BASF and was registered in October 2018. It contains the active ingredient afidopyropen, which is one of several insecticide products with the common name of 'Inscalis'. It is in IRAC group 9D, and the only current member of that group.

PQZ is a new insecticide product from Nichino America that has been registered since August 2018. PQZ contains pyrifluquinazon as the active ingredient. It is in IRAC group 9B, the same group as Fulfill (pymetrozine). It controls aphids, whiteflies, and leafhoppers, and is allowed for use on pome fruit (14-day PHI), stone fruit (7-day PHI), and grapes (3-day PHI).

Movento is allowed for use on blueberries, as specified on a supplemental label since June 2017, but was missed in our Midwest spray guide and previous updates. It is for control of aphids, thrips larvae, and gall midge, and suppression of blueberry maggot and leafhoppers, with a 7-day PHI. The active ingredient is spirotetramat, in mode-of-action group 23. This is the same group as Envidor and Oberon.

Insect Alert!

The 17-year cicada is expected in the area around Youngstown this year. Fruit trees will be attacked. For more info, check our pest management website: u.osu.edu/pestmanagement/

Newsletter Editors:

DR. MELANIE LEWIS IVEY
Fruit Extension Pathologist
Ivey.14@osu.edu
330-263-3849

DR. CELESTE WELTY
Fruit Pest Management
Welty.1@osu.edu
614-292-2803

DR. GARY GAO
Small Fruit Extension Specialist
Gao.2@osu.edu
740-289-2071

BRAD BERGEFURD
Extension Educator
Bergefurd.1@osu.edu
740-354-7879

RACHEL MEDINA
Research Associate
Medina.72@osu.edu
330-263-3846

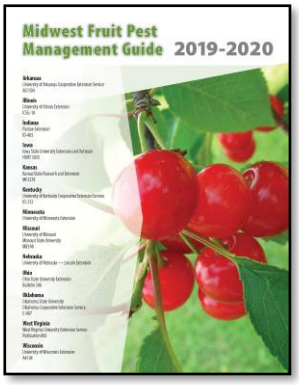
Authors for this edition:

Dr. Melanie Lewis Ivey; Assistant Professor, Department of Plant Pathology; 224 Selby Hall, 1680 Madison Ave., Wooster, OH, 44691; ivey.14@osu.edu; 330-263–3849 (Office)

Dr. Celeste Welty; Associate Professor, Department of Entomology; Bee Laboratory, 2501 Carmack Rd., Columbus, OH, 43210; welty.1@osu.edu; 614-292-2803 (Office)

Mr. Brad Bergefurd, MS., The Ohio State University Horticulture Specialist and Extension Educator for Scioto County; 1864 Shyville Rd., Piketon, OH, 45661; bergefurd.1@osu.edu; 74-289-2071 ext.136 (Office)

Grower Resources:



NEW: Midwest Fruit Pest Management Guide 2019 (ag.purdue.edu/hla/hort/documents/id-465.pdf)

2018 Grape Spray Guide (u.osu.edu/fruitpathology/spray-guides/)

OSU Fruit Pathology Resources (u.osu.edu/fruitpathology)

OSU Fruit and Vegetable Pest Management (entomology.osu.edu)

OSU Fruit and Vegetable Diagnostic Laboratory (u.osu.edu/vegetablediseasefacts/)

OSU Bramble: Production Management and Marketing Guide (Bulletin 782) (extensionpubs.osu.edu)

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Partial Support from the Ohio Vegetable and Small Fruit Research and Development Program