



# INSECTS IN INDUSTRIAL HEMP PRODUCTION IN MICHIGAN



## Author:

**Chris DiFonzo**, Field Crops Entomologist  
MSU Department of Entomology  
& MSU Extension

## Photos contributed by:

- ◆ James DeDecker, Upper Peninsula Research & Extension Center, MSU
- ◆ C.D. DiFonzo, F. William Ravlin & Connor Sturr, Department of Entomology, MSU

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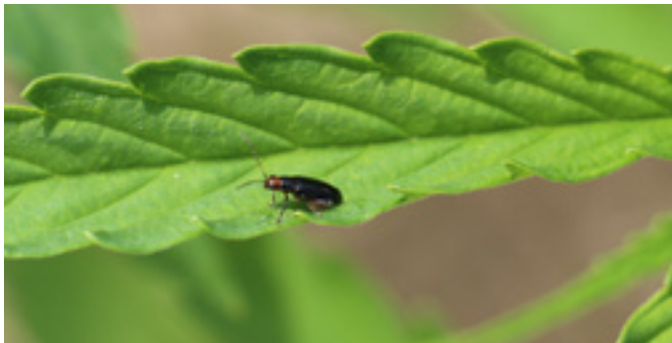
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## About This Bulletin

The 2019 field season was the first in which Michigan growers could legally plant industrial hemp (*Cannabis sativa* L.) in nearly 100 years. Insect pests were not a key limiting factor in Michigan hemp production in the 2019 season, but that may change as hemp production increases.

This bulletin summarizes information on biology, timing, and impact of insect pests in industrial hemp based on observations from the 2019 Michigan field season (Table 1). Where possible, observations made directly in Michigan are distinguished from those made in other states.

**Figure 1:** Flea beetles like this red-headed flea beetle (*Systema frontalis*; top) chew small holes in leaves (bottom) early in the season. (Photos by C. D. DiFonzo)



Most of the insects recorded in Michigan hemp thus far have been generalist species with broad host ranges. These generalists may feed on multiple crops, ornamentals, trees, or weeds. They were present in the landscape before hemp was planted and they will visit or colonize hemp to some degree every year. High pest populations in the future likely will be tied to favorable environmental conditions OR to their mass movement from overwintering areas or nearby hosts. Since there were no reports of economic damage by insects to industrial hemp in 2019, experiences in other field crops or in the greenhouse are used to speculate on potential future impacts.

## Early Season Defoliators

Most of the defoliators observed thus far on Michigan hemp also feed on other crops, trees, and weeds in the landscape. None are expected to cause serious damage to fast-growing stands of hemp. Early in the 2019 field season, flea beetles (Figure 1) were observed chewing small round holes in leaves. Beginning in July, caterpillars of several lepidopteran species – including painted lady butterfly (*Vanessa cardui*), yellow-striped armyworm (*Spodoptera ornithogalli*), zebra caterpillar (*Melanchra picta*), tussock moths, and obliquebanded leafroller (*Choristoneura rosaceana*; Figure 2) – and southern corn rootworm (*Diabrotica undecimpunctata*; also known as spotted cucumber beetle) and Japanese beetle (Figure 3) were observed feeding on leaves.

## INSECTS IN INDUSTRIAL HEMP PRODUCTION IN MICHIGAN

**Table 1:** Calendar of Insect Pest Occurrence and Damage, From Early to Late Season, in Michigan Industrial Hemp Production.

Pest Species	Overwintering stage & habitat	Emergence: Seedlings	Early season: Vegetative growth	Reproduction: Leaves, flowers & buds	Late season: Seed heads & mature stems
Flea beetles (several species)	Eggs in soil	Chew small round holes in leaves.	Chew small round holes in leaves.		
Grasshoppers (several species)	Eggs in soil		Feed on leaves and small stems.		
Japanese beetle ( <i>Popillia japonica</i> )	Larvae (grubs) in soil		Skeletonizes leaves.	Feeds on flowers.	
Lepidopteran caterpillars (several species)	Varies by species		Defoliate leaves.	Defoliate leaves.	
Tarnished plant bug ( <i>Lygus lineolaris</i> ) & related Lygus bugs	Adults in residue and on field edges		Pierces and sucks on leaves.	Feeds on flowers and developing seeds.	Feeding may lead to aborted flowers or seeds.
Southern corn rootworm ( <i>Diabrotica undecimpunctata</i> )	Doesn't overwinter in Michigan			Feeds on leaves.	
Cannabis aphid ( <i>Phorodon cannabis</i> )	Eggs on hemp residue			Pierces and sucks on leaves. Feeding may distort flowers.	Populations should decline on mature plants.
Black bean aphid ( <i>Aphis fabae</i> )	Eggs on viburnum and euonymus shrubs			Pierces and sucks on leaves, may damage flowers.	Populations should decline on mature plants.
Twospotted spider mite ( <i>Tetranychus urticae</i> )	Adult females in leaf litter and residue			Pierces and destroys individual plant cells (called "stippling").	Leaf drop and yield loss from sustained heavy infestation; webbing may cover seed head.
Hemp russet mite ( <i>Aculops cannibicola</i> )	Unknown			Pierces individual plant cells; heavy infestations can develop in mature buds.	Potential to reduce bud size and CBD production.
Stink bugs (several species)	Adults in protected areas			Pierce and feed on developing seeds.	Feeding may lead to aborted seeds.
European corn borer ( <i>Ostrinia nubilalis</i> )	Larvae in corn stalks and hemp stems			Bores into stems.	Potential for stem breakage.
Hemp borer ( <i>Grapholita delineaana</i> )	Larvae in hemp stems and residue and [perhaps] in alternate weed hosts			Bores into upper stem and kills buds.	May consume seeds directly.
Corn earworm ( <i>Helicoverpa zea</i> )	Doesn't overwinter in Michigan			Chews into buds and developing seed heads.	Potential for serious damage to seed head by end of season.

Note: Cells shaded in gray indicate the pest isn't present or damaging at that stage.

In hemp production in Colorado, grasshoppers are the most important leaf and stem defoliators. But in Michigan in 2019, Japanese beetles were among the most prominent species feeding on leaves. Japanese beetle adults are common in Michigan field crops, so their presence in hemp is not a surprise. Furthermore, they tend to cluster on the tops of plants, especially along field edges, which makes them easy to spot.

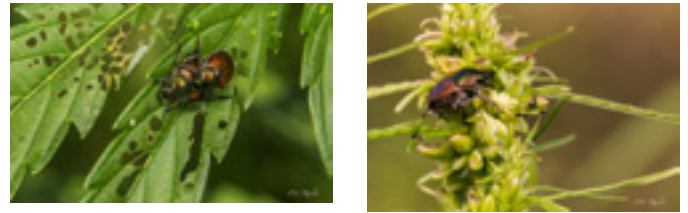
## Sucking Pests

Sucking insects feeding on hemp leaves in early to mid-season tend to be generalist species. Several examples are described in this section.

**Figure 2:** Caterpillars feeding on hemp in Michigan. Banded (*Halysidota tessellaris*; top left) and white-marked (*Orgyia leucostigma*; bottom left) tussock moths; obliquebanded leafroller (*Choristoneura rosaceana*) in webbing (top right) and in closeup (bottom right). (Photos by C. D. DiFonzo)



**Figure 3:** Japanese beetle (*Popillia japonica*) adults skeletonize leaves (left) and feed on hemp flowers (right) in July and August. They are easy to spot because of their habit of hanging out toward the tops of plants. (Photos by F. William Ravlin)



## PLANT BUGS

Plant bug (especially tarnished plant bug or TPB, *Lygus lineolaris*; Figure 4) is common. TPB adults overwinter in crop residue or along field margins and thus can be present early in the season. Later in the season, TPB will feed on developing seeds in, for example, fields planted for hemp fiber.

## PLANT HOPPERS

Many species of plant hoppers were found in hemp in the 2019 field season in Michigan.

Potato leafhopper (PLH, *Empoasca fabae*; Figure 5), is a key pest in dry beans, alfalfa, and certain vegetable crops in Michigan, but its characteristic damage (called “hopperburn”) has not been reported in hemp in the state. It does not overwinter in Michigan and must recolonize from southern states each year. Its ultimate population level in a given year

depends on the timing and intensity of its northward migration.

The honeylocust treehopper (*Microtalis calva*; Figure 6) was collected in Michigan hemp fields in 2019. This species is known to complete development on hemp in the eastern and western U.S.

**APHIDS**

Relatively few aphid species infest hemp. On indoor cannabis production in the U.S., several species have been recorded, including black bean (*Aphis fabae*), cotton-melon (*Aphis gossypii*), foxglove (*Aulacorthum solani*), and green peach (*Myzus persicae*). These polyphagous species are common greenhouse pests, reproducing quickly and parthenogenically (that is, without mating). They feed relatively gently by plugging into phloem

tissue and sucking plant sap from it. In heavy infestations, plants become covered with sticky honeydew excreted from the aphids' digestive tracts.

The rice-root aphid (*Rhopalosiphum rufiabdominale*) is a widespread root-feeder in hydroponic greenhouses in the U.S. In 2016, this aphid was confirmed in hydroponic cannabis production in Michigan, but has not been found in hemp fields.

Outdoors, black bean aphid was observed on hemp in mid to late summer in Michigan. It likely overwinters in the egg stage on viburnum and euonymus shrubs, then colonizes crop hosts in the spring. The colonies of small blackish aphids on leaves are often tended by ants. As a polyphagous species, the black bean

**Figure 4:** Tarnished plant bug (*Lygus lineolaris*) adults (left and center) and nymphs (right) are among the most common sucking insects found in hemp fields early in the season, feeding on leaves. Later in the season, they feed on developing seeds. (Left and center photos by F. William Ravlin, right photo by C. D. DiFonzo)



**Figure 5:** Potato leafhopper (*Empoasca fabae*) is a key pest of many Michigan crops, but its status in hemp is unclear as of this writing in early 2020. (Photo by F. William Ravlin)



**Figure 6:** The honeylocust treehopper (*Microtalis calva*) is among the many incidental plant hopper species found on hemp foliage. (Photo by F. William Ravlin)



aphid feeds on many crops, ornamentals, and weeds in the field.

In contrast, the cannabis aphid (*Phorodon cannabis*; Figure 7), is a cannabis specialist that overwinters in the egg stage on hemp residue. It is native to Europe and Asia, but in 2016 it was found in Colorado in both outdoor hemp and indoor cannabis production. Winged migrants were subsequently collected in aerial suction traps in six Midwestern states. In 2019, it was collected in an industrial hemp plot in the Upper Peninsula of Michigan.

Overall, aphids are unlikely to pose a problem in hemp fields because they will be exposed to adverse weather conditions and many natural enemies. Aphids on greenhouse transplants will decrease rapidly once the plants are moved outdoors. An exception may be in hot dry seasons, when plants are water-stressed, aphids reproduce quickly, and honeydew doesn't wash off plants (this leads to

**Figure 7:** Cannabis aphids (*Phorodon cannabis*) on the underside of a hemp leaf in the Upper Peninsula of Michigan. (Photo by James DeDecker)



the growth of sooty mold on leaves and flowers).

### MITES

Mites may prove to be important pests of hemp under the right conditions. Two mites that could become particularly problematic are the twospotted spider mite and the hemp russet mite.

The twospotted spider mite (*Tetranychus urticae*; Figure 8) is a common and difficult pest to manage in greenhouses. Spider mites feed by piercing individual plant cells, resulting in tiny yellow spots called "stippling." As spider mite populations increase, their webbing - which they use as a sort of superhighway - may become visible on plant surfaces. Infestations usually start on field edges and move inward.

In most years, populations of spider mites in field crops don't build up to economic levels. But in hot dry years, outbreaks have been devastating to Michigan soybeans, dry beans, and corn. Outbreak-level populations worsen drought stress as damaged plant cells lose water. They

**Figure 8:** Although this closeup photo was taken on corn, not hemp, it illustrates the key features of a heavy twospotted spider mite (*Tetranychus urticae*) infestation: a multitude of tiny yellow mites and their shed skins, webbing on the leaf surface, and damage to individual plant cells (called "stippling") caused by mite feeding. (Photo by C. D. DiFonzo)



also reduce crop yields through yellowing, leaf drop, and actual plant death.

Hemp would likely suffer a similar fate in drought years that give rise to heavy spider mite outbreaks.

The second mite of concern is the hemp russet mite (*Aculops cannabicola*; Figure 9). Its population apparently can explode indoors and it has been reported as a serious pest in hemp fields late in the season in a few states. The symptoms of hemp russet mite infestation on leaves – curling and discoloration (Figure 10) – are less obvious than spider mite damage. However, this mite can infest developing flowers, reduce bud size, and reduce cannabidiol (CBD) production from trichomes.

Little is known about hemp russet mite biology, overwintering habitat, alternative hosts, and natural enemies. Hemp russet mite has been reported in fields in other states, but hasn't been confirmed in Michigan hemp yet, so Michigan producers and researchers have minimal field experience with this pest.

**Figure 9:** Hemp russet mites (*Aculops cannabicola*) developing on new leaves around bud. (Photo by Whitney Cranshaw, Colorado State University, Bugwood.org)



## Later Season Flower, Bud & Seed Feeders

Insects that attack the reproductive structures of hemp are of more concern to growers than those attacking the leaves. This concern arises because the buds are the source of trichomes, which produce pharmaceutical compounds such as CBD, as well as the seeds needed to produce oil and to sell directly for planting. These three uses all have more economic value than fiber production.

Both plant and stink bugs feed on and damage the blooms and seeds of many crops. Feeding by tarnished plant bug adults and late-stage nymphs (*Lygus lineolaris*; Figure 4) can cause abortion of flowers and can damage developing seeds in host crops, and both TPB stages are present in hemp during flowering and seed formation. TPB adults will also move en masse out of less-favorable fields (for example, mature alfalfa that is being cut) into neighboring crops. This behavior sometimes results in high TPB populations in and damage to dry beans and sugarbeets in Michigan. It wouldn't be

**Figure 10:** Curling and discoloration to hemp bud and new leaves caused by hemp russet mite (*Aculops cannabicola*). (Photo by Whitney Cranshaw, Colorado State University, Bugwood.org)





surprising for plant bug injury to eventually be reported on hemp growing near alfalfa fields being cut in midsummer.

Several stink bug species are commonly reported feeding on hemp flowers and seeds in the U.S. Stink bugs seem to be increasing in field crops in the Midwest, and one species, *Euschistus variolarius* (the onespotted stink bug; Figure 11) is particularly common in Michigan field crops.

Stink bugs colonize and increase in winter wheat early in the season in Michigan, then the adults move into neighboring corn and soybean fields after the midseason wheat harvest. It is likely that they also would move into any adjacent hemp fields, which would be flowering at that time and therefore attractive to adults.

The invasive brown marmorated stink bug (BMSB) breeds on hemp in the eastern U.S. In Michigan, soybean sampling

**Figure 11:** The onespotted stink bug (*Euschistus variolarius*) has been the most common stink bug collected in corn and soybeans in Michigan for the past several seasons, and has been seen in hemp fields as well. Stink bugs tend to colonize field crops later in the season, when seeds are beginning to develop. (Photo by C. D. DiFonzo)



has shown that BMSB typically is found in fields near built environments (that is, near towns) but occurs less frequently in environments where field crops predominate.

## Pests in Mature Stems & Seed Heads

Several insects bore into hemp stems and stalks. One such insect is the European corn borer (ECB; *Ostrinia nubilalis*; Figure 12), which is a major introduced pest of corn in the U.S. As the name implies, the larvae of this pest bore into and weaken corn stalks, reducing the yield and harvestability of the broken plants.

Historically, ECB caused serious injury to hemp in parts of Europe. ECB was accidentally introduced into the U.S. in the early 1900s and was reported in hemp fields before World War II. The

**Figure 12:** European corn borer (*Ostrinia nubilalis*; left column) has the potential to be a pest of hemp if it tunnels into the bases of plants or causes stem breakage. In 2019, corn earworm (*Helicoverpa zea*; right column) was reported infesting buds in hemp fields.

**Note:** The caterpillars of both pests were photographed on corn, not hemp. (Moth photos by C. Sturr, caterpillar photos by C. D. DiFonzo)



EUROPEAN CORN BORER

CORN EARWORM

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widespread adoption of transgenic Bt (*Bacillus thuringiensis*) corn in the 1990s greatly reduced ECB populations in corn. However, as some growers return to conventional corn, it wouldn't be surprising to see ECB populations increase. There have been a few anecdotal reports of heavy ECB infestations of hemp in neighboring states, but none yet in Michigan.

The Eurasian hemp borer or hemp moth (*Grapholita delienseana*) has been recorded in many states. There are no hemp borer

specimens in MSU's A.J. Cook Arthropod Collection to document this pest's presence in Michigan, but it is likely here. In Colorado it is found everywhere that hemp is grown, and is assumed to have one or more alternate weed hosts.

Like ECB, hemp borer larvae feed inside plant stems, killing smaller plants outright or creating weak points where their stems break. Unlike ECB, it is a specialist on hemp and may have significant potential as a pest. Later generations tunnel into

**Table 2:** Insecticides Approved by the U.S. Environmental Protection Agency for Use in Industrial Hemp Production.

Trade name (Manufacturer)	EPA registration	Michigan Registered?	Active ingredient(s)	Other information
Debug-ON Emulsifiable Concentrate Antifeedant, Insect Repellent, Insecticide, Miticide, Fungicide (Agro Logistic Systems)	70310-11	No	Neem oil (70%)	Organic Materials Review Institute (OMRI) listed.
Debug Optimo Emulsifiable Concentrate Antifeedant, Insect Repellent, Insecticide, Miticide, Fungicide, Nematicide (Agro Logistic Systems)	70310-7	No	◆Neem oil (15%) ◆Azadirachtin	OMRI listed.
Debug Trés Emulsifiable Concentrate Antifeedant, Insect Repellent, Insecticide, Miticide, Fungicide, Nematicide (Agro Logistic Systems)	70310-8	No	◆Neem oil (4.7%) ◆Azadirachtin	OMRI listed.
Debug Turbo Emulsifiable Concentrate Antifeedant, Insect Repellent, Insecticide, Miticide, Fungicide, Nematicide (Agro Logistic Systems)	70310-5	Yes	◆Neem oil (66%) ◆Azadirachtin	OMRI listed.
General Hydroponics Azamax Botanical Insecticide / Miticide / Nematicide (Hawthorne Hydroponics)	91865-4	Yes	Azadirachtin	Targets true bugs, leafhoppers, whiteflies, aphids, mites, beetles, thrips, leafrollers, cutworms, & armyworms. OMRI listed.
General Hydroponics Exile Insecticide / Fungicide / Miticide (Hawthorne Hydroponics)	91865-2	Yes	Potassium salts of fatty acids	Targets soft-bodied insects (such as aphids, plant bugs, thrips, whiteflies), spider mites, & powdery mildew. OMRI listed. See supplemental label for hemp.
General Hydroponics Prevasyn Insect Repellent / Insecticide (Hawthorne Hydroponics)	91865-1	Yes	◆Soybean oil ◆Garlic oil ◆Capsicum	Targets soft-bodied insects. See supplemental label for hemp.

**Note.** All of these insecticides are best suited for indoor production. EPA and Michigan registrations valid as of April 29, 2020.

stems at the bases of the buds, which can kill the buds outright. This borer can also infest flowers and consume seeds directly. It is an insect to watch for as commercial hemp production increases in the state.

The late-season insect with the most potential to damage hemp, at least based on experiences in Colorado and reports in Michigan in 2019, is the corn earworm (*Helicoverpa zea*; Figure 12). Every bud-feeding caterpillar from hemp submitted to MSU Diagnostic Services in 2019 was identified as earworm. Earworm does not overwinter in Michigan. Instead, the moths migrate from the southern states each season.

Earworm has a wide host range and its larvae typically attack the reproductive structures of crops. In corn, larvae infest the ears, although infestations rarely reach economic levels in Michigan except in sweet corn. In corn, earworm moths prefer to lay eggs near fresh silks. Hemp fields may become attractive for egg-laying when the surrounding corn fields have been pollinated and their silks are drying.

In hemp, earworm larvae feed on seed heads or in buds. The impact of earworm in hemp in Michigan will depend on the intensity and timing of its northward migration. The pest typically reaches Michigan in August, although in recent years it has arrived earlier in the summer and has been much more apparent in corn.

As more non-GMO corn is grown or earworm resistance to Bt corn increases in the southern states, earworm may resurge as a pest and spill over into hemp fields. The bottom line is that corn earworm has the potential to become the most damaging insect to industrial hemp production in Michigan.

## Notes on Management

Managing insect pests in hemp will require a combination of monitoring and scouting, protecting natural enemies, and (perhaps in the long term) applying pesticides.

### MONITORING & SCOUTING

The foundation of any pest management system is scouting to identify which pests are present, their stage of development, and their population levels. Scouting is especially important in hemp fields because the crop is new to the state and there is much to be learned even from simple observations.

Early in the season, small plants can be sampled by sweep netting, but as plants mature, sweeping becomes impractical. Direct observation of insect pests on plants can be made by handling the foliage or beating the leaves into an open sweep net or onto white paper (disposable paper plates work well to detect spider mites). The insects of greatest concern (aphids, mites, seed-feeding bugs) will be visible either with the naked eye or through a hand lens.

Borers hide in plant stems and buds, but observers can see signs of them – such as frass (excrement), leaf flagging, and tip death – at the top of plants. In CBD production, workers who are walking fields to rogue male plants can scout for common insect pests and their damage at the same time.

The flight of European corn borer and corn earworm can be monitored using pheromone traps placed on the edges of fields (Figure 13). Specific pheromone lures attract male moths of the targeted species. Scouts can count the trapped males to measure the timing and intensity of flights. This data is useful when scheduling scouting trips to look for stem and bud damage.

**Figure 13:** The timing and intensity of corn earworm (*Helicoverpa zea*) or corn borer (*Ostrinia nubilalis*) moth flight can be monitored using a *Heliothis*-style pheromone trap placed on the edge of the field. A specific pheromone lure hung in the trap attracts male moths of each species, which fly upward into a collection basket at the top of the trap. (Photo by C. D. DiFonzo)



Southern and mid-Michigan typically have two corn borer generations per field season – with flights roughly in early June and late July. The second generation is more likely to colonize hemp.

Traps can help detect the arrival of corn earworm from the south and the intensity of the pest’s movement. There is no commercially available pheromone lure for hemp borer.

### NATURAL ENEMIES & OTHER BENEFICIAL INSECTS

Most insect pests in Michigan field crops are kept in check by natural enemies, and hemp should be no different. Many “good bugs” were observed in hemp fields (Figure 14) throughout the 2019 field season. Hemp fields likely will serve as a source or a refuge for natural enemies in the landscape. First, conventional insecticides are not being applied to hemp fields. Second, hemp stands tend to be weedy, and the weeds supply the natural enemies with pollen and ready prey.

Pollinators (bees and flies) were common in some fields, attracted to male hemp plants and weeds flowering in the crop

**Figure 14:** Insect natural enemies observed in hemp fields. Ladybird beetles (far left and center left) and lacewing larvae (center right shows lacewing egg on hemp stalk) are important natural enemies of aphids and other small insects. The spined soldier bug (*Podisus maculiventris*, far right) is a predator of caterpillars and beetle larvae. (Ladybird and lacewing photos by C. D. DiFonzo; stink bug photo by F. William Ravlin)



(Figure 15). Male plants are undesirable and rogued when they appear in fields grown for CBD, but they are present in fiber fields. Male flowers may also be present in small numbers on hermaphroditic plants.

### INSECTICIDES

The U.S. Environmental Protection Agency (EPA) is responsible for registering pesticides in the U.S. and for approving labels. No pesticides are specifically registered on **marijuana** due to its classification as a controlled substance on the federal level. However, in 2019, EPA approved a handful of insecticides for use on industrial hemp (Table 2).

All of these insecticides are naturally derived products that require multiple applications and thorough coverage to be effective. They have the most utility in controlled environments such as greenhouses, where aphids, thrips, and mites are the key pests. However, these products are expensive and likely must be applied too frequently for use in outdoor hemp production. Also, none of them would be very effective against corn earworm, corn borer, or hemp borer.

## Resources

### JOURNAL ARTICLE

Cranshaw, W., Schreiner, M., Britt, K., Kuhar, T. P., McPartland, J., & Grant, J. (2019). Developing insect pest management systems for hemp in the United States: A work in progress. *Journal of Integrated Pest Management*, 10(1), 1-10. <https://doi.org/10.1093/jipm/pmz023>

### MICHIGAN STATE UNIVERSITY RESOURCES

- **MSU Extension Hemp Production** (<https://www.canr.msu.edu/hemp/index>) - This page offers resources, webinars, programs and current information on industrial hemp production in Michigan. Other sections of the MSU Extension website ([extension.msu.edu](https://extension.msu.edu)) offer information on integrated pest management, IPM- and entomology-related training opportunities, and much more.
- **MSU Plant and Pest Diagnostics** (<http://pestid.msu.edu/>) - The diagnostic clinic provides plant health analyses and identification of nematodes, weeds, insects, and other arthropods. Visit the website for information on how to submit specimens and photos of insects or insect damage for identification (fee may apply). Phone 517-355-4536, email [pestid@msu.edu](mailto:pestid@msu.edu).

**Figure 15:** In fields with male flowers, pollinators were numerous. Examples recorded in 2019 were (from left) bumble bees, honey bees, bee flies (*Bombyliidae*) and flower flies (*Syrphidae*; photographed on a soybean leaf). (Photos by F. William Ravlin and C. D. DiFonzo [far right])



## ONLINE RESOURCES

- **Colorado State University Hemp Insect website** (<https://hempinsects.agsci.colostate.edu>) – Extensive website offers fact sheets about insect pests of hemp, a photo gallery of pest and beneficial insects found in hemp fields, and recommendations for managing selected hemp pests.
- **Great Lakes and Maritimes Pest Monitoring Network** – The network provides an interactive real-time map and a data dashboard that summarize weekly pheromone trap counts by pest species (including corn borer and corn earworm). The trap counts come from crop consultants, scouts, Extension staff members, farmers, and researchers from three Great Lakes states (Michigan, New York, and Ohio) and six Canadian provinces (Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). (**Note:** As of this writing in mid-2020, the network website was in the process of changing hosts and the new address wasn't available yet, so you'll need to search on the network name to find the website.)

- **Pest and Crop Newsletter** (<https://bit.ly/2PL4s6k>) – Free electronic newsletter from Purdue University Extension and Department of Entomology provides timely field crop information on pest problems, crop development issues, and weather events. Offers trapping data for European corn borer and corn earworm. (Weekly trap counts from Indiana provide an early warning to Michigan growers as corn earworm migrates northward each year.) Published weekly throughout the growing season. Look for the “Subscribe” button on the website.

## TRAPPING SUPPLIES

- **Great Lakes IPM** (<https://www.greatlakesipm.com/>) – The company, located in Vestaburg, Michigan, sells a range of integrated pest management products, including Heliothis traps for European corn borer and corn earworm, and pheromone lures for both species. (The Iowa/IA strain lure is recommended for trapping European corn borer in Michigan.) Phone 989-268-5693 or (toll-free) 800-235-0285, email [glipm@greatlakesipm.com](mailto:glipm@greatlakesipm.com).