

# Insect Pests on Soybeans in New York State IPM Field Teaching Module

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Concept	Activity	Handouts
To manage insect pests, growers need to know their lifecycle and how to identify them	Learn how to identify insect pests and know their lifecycle	Iowa State University Soybean Disease and Pest Management Field Guide.
To make sound management decisions, growers need to know how monitor pests and determine economic thresholds and ...	Scout insect pests; decide how to manage them	Iowa State University Soybean Disease and Pest Management Field Guide.
... what their management options are		
Resources: Cornell Guide to Integrated Field Crop Management.	Related Modules: <a href="#">Module 2: Introduction to IPM</a> <a href="#">Module 3: Principles of Scientific Sampling</a> <a href="#">Module 4: What is a Threshold?</a> <a href="#">Module 5: Economic Implications of IPM</a>	

## Here's what we'll do:

**Beforehand:** Set up a field meeting with a host farmer

## Today on-site:

- Learn how to correctly identify
  - seed corn maggot (*Delia platura*)
  - Japanese beetle (*Popillia japonica*)
  - bean leaf beetle (*Cerotoma trifurcata*)
  - Mexican bean beetle, (*Epilachna varivestis*)
  - two-spotted spider mites (*Tetranychus urticae*)
- Learn their lifecycles
- Become skilled at sampling and monitoring for them
- Know how to manage them in soybeans
- Learn how to identify beneficial organisms that reduce pest populations.

<b>ACTIVITY # 1:</b> Identify seed corn maggots, Japanese beetles, bean leaf beetles, Mexican bean beetle and two-spotted spider mites			
Setting	Time Required	Materials	Handouts
Soybean Field	30 minutes	Clipboards Hand-lens, 10 – 20x Optional: dissecting scope for spider mites	Iowa State University Soybean Disease and Pest Management Field Guide.

Q:	Pose a series of questions:	A:
What insect pests in New York could cause losses for soybeans?	Soybean aphid, seed corn maggots, Japanese beetles, bean leaf beetles, Mexican bean beetle, and two-spotted spider mites are the most important pests.  Note that soybean aphid is the most destructive. See <i>Soybean Aphids (SBA) in New York State IPM Field Teaching Module</i>	
At what growth stages are plants most vulnerable to infestations?	Infestation at the R1 to R5 growth stage can dramatically affect yields if infestation levels exceed threshold. (This goes for diseases too.)	
<b>Seed Corn Maggot</b>		
What insect pest can infest soybean seeds in the soil?	Seed corn maggot.	
Where do seed corn maggots come from?	Adult female flies (looking much like house flies) lay eggs in field early in the growing season. Eggs hatch. Maggots, attracted to soybean seeds, feed inside them.	
What time of year do the maggots infest soybeans?	May and June	
What conditions attract these flies?	Moist soil cracks, high organic matter, decomposing plant material, and germinating seeds.	
What do maggots look like?	Legless, appear to be headless; tapered, pale yellowish-white, grow to about ¼". (See field guide for pictures)	
What attracts maggots to the seed?	Sprouting seeds give off CO <sub>2</sub> , attracting maggots that burrow in to feed (and pupate).	
Once maggots get into seeds, what happens to the plants?	Seeds often don't germinate; seedlings are weak and often die. Note skips in rows where plants should have emerged.	

What conditions increase the potential for damage?	Cool, wet spring weather that delays seedling emergence gives maggots more time to find and infest seed.
Do past manure applications increase risk of damage?	Yes. Fields the second year after manure seem more prone to SCM damage than those in their first year.
Do maggots cause much yield loss?	In simulated studies at Cornell University, soybeans were planted at 200,000 seeds per acre—then 25% and 50% of seedlings were removed. The 25% removal rate showed no yield loss; the 50% removal rate showed only slight losses. Yield loss in NY is unlikely except in extreme cases.
<b>View live specimen or a photo of seed corn maggot and their damage.</b>	
<b>Japanese beetle</b>	
What insect pests feed on leaflets?	Japanese beetle; bean leaf beetle, Mexican bean beetle
Which is most common on soybeans?	Japanese beetle
What do they look like?	Metallic green with red or brownish wing covers. Robust at 1/3 to 1/2 inch. (See field guide for pictures)
What is the larval stage form called?	White grubs. Feed on grass roots—your lawn, corn, wheat, and pasture.
What time of year do Japanese beetles infest soybeans?	June and July
What damage will you see?	Note skeletonized, browning leaves.
Do Japanese beetles cause yield losses to soybeans?	Damage can look really bad ... but rarely causes yield loss. Soybeans can take a good deal of defoliation before loss occurs.
<b>View live specimen or photo of Japanese Beetle and their damage.</b>	

<b>Bean leaf beetles—BLB</b>	
Are bean leaf beetles found in New York?	Yes... as of 2009 BLB appear limited to a few areas in western NY. Though BLB has been found in Ohio, Pennsylvania and Ontario, it's not yet a widespread problem in NY.
What do they look like?	Actually, BLBs have a range of colors and patterns. They're small—about 1/4 inch. Can be golden brown, reddish, or green. Most, but not all have four black spots on the elytra—the wing covers—and all have a triangular shaped spot behind their head on the end of their thorax. (See field guide for pictures)
What kind of damage should I look for?	Infestations can cause economic losses. Adults feed on leaves and pods. Overwintered adults can feed on emerging plants ( <i>cotyledons, stems, unifoliate leaves, and emerging trifoliolates</i> ). As the season continues, first and second generations feed on leaves, creating small round holes.
What's the life cycle? Do the larvae damage plants?	Adult BLBs lay orange eggs on the soil next to plant stems and hatch in 10 or 11 days. Larvae are cylindrical with a white body and black head. They feed on the nitrogen-fixing nodes on the roots. But while larvae damage roots, the leaf-feeding adults cause most losses.
When can you find them?	From June till harvest.
What's their life cycle?	Two generations per season. BLBs overwinter as adults and can infest fields early in the season.
<b>View live specimen or a photo of bean leaf beetle and their damage.</b>	
<b>Mexican bean beetle (MBB)</b>	
Are MBB found in New York?	Yes, in central and western NY.
They are part of a family of insects called....?	Coccinellidae—otherwise known as lady beetles or lady bugs. Most species in this family are important predators of insect pests. This is one of few lady beetles that damage crops.
What do they look like?	Adults are round, about a ¼ inch across. Early on, they're yellow, but change to copper as they mature. They always have 16 spots: 8 on each wing cover ( <i>elytra</i> ).

Do MBBs overwinter in the Northeast?	Yes. Adults overwinter under debris, windrows, fence rows, etc.
When can you find them?	As plants emerge in June; continue until harvest.
What do eggs and larvae look like?	Females lay clusters of 50 to 70 of yellowish eggs at a time over 2 or 3 days on leaf undersides. Eggs hatch in 5 to 24 days. A full-grown larvae is up to 1/3 inch long and yellow with spines protruding from the body.
What damage do larvae cause?	They feed on leaf undersides, skeletonizing them.
What damage do adults cause?	Like larvae, they feed on leaf undersides, skeletonizing them.
<b>View live specimen or photo of Mexican bean beetle and their damage.</b>	
<b>Two-spotted spider mite</b>	
Is this an insect pest?	No. Insects have six legs. Mites have eight. They're more closely related to spiders.
What's their life cycle?	Adult mites lay really tiny eggs on plants. Nymphs hatch—looking much like adults, only smaller.
Do nymphs have eight legs?	No... they have six legs, developing two more as they mature.
What do they look like?	<i>Really</i> small; less than 0.002 inches long. You'll need a 30+ hand lens or a dissecting scope to see them. (See field guide for pictures.) Note two spots on either side of their back.
What signs should I look for?	Spider mites make fine, silky webs. Heavily infested fields show webbing on leaflets and petioles (where the leaves meet the stem). Heavily infested leaves will be stippled yellow with lots of tiny dots.
Can spider mites fly?	No—but they can float. Their silk threads can carry them far on a breezy day, which is how they move to new fields.
What signs of damage should I look for?	Stippled leaves are an early feeding sign. Later, note bronzed leaves. Injury can look like a fungal disease.
When should you watch for them?	July through August
What conditions favor spider mites?	They prefer long bouts of hot, dry weather. You rarely see damage when it's wet and or cool.

<p>Can effect do some insecticides have on spider mites?</p>	<p>Early season applications of pyrethroids (tank mixed with herbicide like roundup) often trigger spider mite outbreaks when the weather turns warm and dry.</p> <p>Resist the urge to “just add insecticide” to herbicides. These early applications also can trigger soybean aphid rebounds by killing off the beneficial insects—requiring a second application to prevent loss.</p>
<p><b>Scout for insect pests and their damage. Collect insects and damaged plant parts. Discuss them in the group.</b></p>	

<p><b>ACTIVITY # 2: Monitoring and Management</b></p>			
Setting	Time Required	Materials	Handouts
Soybean Field	30 minutes	Clipboards	Iowa State University Soybean Disease and Pest Management Field Guide.

Q:	Pose a series of questions:	A:
<p>How can I manage seed corn maggot?</p>	<p>Prevention is key. <i>Conventional growers</i> can use insecticide-treated seed, keeping maggots from entering seeds in the first place. <i>Organic growers</i> can till in all residue, reducing attractiveness to adult females. And wait until soil temperature is 50 – 55 degrees so seed can sprout quickly and keep ahead of the maggots. If soil is cold, seeds will just sit there, letting maggots (and pathogens) enter.</p> <p>To check for problems conduct a plant population count. If the plant population is significantly lower that what you planted. Check the seed for the maggots. A 10% loss to this pest is not uncommon.</p>	
<p>Can I treat once they're in the seed?</p>	<p>No insecticides work at this stage. Prevention is key.</p>	

<p>What is the economic threshold defoliar insects like Japanese beetles, bean leaf beetles, and Mexican bean beetles?</p>	<p>Look at 5 plants in 5 different locations in the field and estimate the percent defoliation.</p> <p>Soybeans can take lots of damage and it won't affect yield. Thresholds:</p> <ul style="list-style-type: none"> <li>35% defoliation until bloom</li> <li>20% when pods are small and soft</li> <li>35% after pods harden</li> </ul> <p>Note: Know that soybeans can compensate for damage and still not reduce their yield, even at up to 1/3 tissue loss.</p>
<p><b>Scout for insect pests and their damage. Collect insects and damaged plant parts. Discuss them in the group. Look at pictorial guide on the defoliation estimates on page 50 of the Iowa State University Soybean Disease and Pest Management Field Guide. Collect leaves and discuss the thresholds.</b></p>	
<p>How can I deal with defoliation species of insects in soybeans?</p>	<p>Several insecticides are labeled, if you reach economic threshold.</p>
<p>How do I scout for two-spotted spider mite?</p>	<p>Spider mites normally feed first on weeds along field edges. Scout the edges to detect them early in the season. You should</p>
<p>Which insecticides sometimes cause spider mite populations to increase?</p>	<p>By using pyrethroid insecticides, you may get a resurgence of spider mites. The spider mites have a resistance to this insecticide. Plus, by spraying the insecticide you can destroy the predators and parasites of the mites.</p>
<p>At what stage of plant development can spider mites do most of their damage?</p>	<p>Between R4 and R5 are critical times in affecting the yields of soybeans.</p>
<p>How should I scout for two-spotted spider mites?</p>	<p>Walk a "U" pattern, checking at least look at 5 plants in 5 different locations in the field. Assess damage with this scale: Check fields every 4-5 days during dry weather, since damaging infestations can develop quickly.</p>

<p>Look for ...</p>	<p><b>Stippled Leaves</b>                  0 – No spider mites or injury                  1 – Minor stippling on lower leaves; no premature yellowing                  2 – Frequent stippling on lower leaves; yellowing on small areas or scattered plants                  3 – Heavy stippling and distinct yellowing on lower leaves; some stippling in middle canopy. Mites present in middle canopy; scattered colonies in upper canopy. Patches of lower leaf loss. <b>(Spray or Economic Threshold)</b></p>
	<p><b>Mites on Leaves</b>                  4 – Heavy yellowing easily seen on lower leaves; some leaves drop. Frequent stippling, webbing, and mites in middle canopy. Some mites and minor stippling in upper canopy. <b>(Economic Loss)</b>                  5 – Frequent lower leaf loss; yellowing and browning shows higher in middle canopy; frequent stippling and distortion of upper leaves. High levels of mites in middle and lower canopy.                  (Adapted from <i>Managing Two-Spotted Spider Mites on Soybeans and Corn in Minnesota</i>. K. Ostlie and B. Potter)</p>
<p>When should I spray the field for spider mites?</p>	<p>At the level 3 or above and damage is uniform throughout the field you should consider spraying an insecticide.                  NOTE: spraying with pyrethroids for soybean aphids can make spider mites flare up. Don't use pyrethroids on spider mites—they don't work.</p>

<p><b>ACTIVITY # 3: Biological Control of Insect Pests in Soybeans</b></p>			
<p>Setting</p>	<p>Time Required</p>	<p>Materials</p>	<p>Handouts</p>
<p>Soybean Field</p>	<p>30 minutes</p>	<p>Clipboards</p>	<p>Iowa State University Soybean Disease and Pest Management Field Guide.</p>

Q:	Pose a series of questions:	A:
What is biological control, <i>aka</i> biocontrol?		Controlling pests with organisms such as natural predators, parasites, or pathogens.
What kinds of biocontrol agents attack soybean pests?		<p>Predators: lady beetles, lacewings, big-eyed bugs, assassin bugs, minute pirate bugs, and more.</p> <p>Parasitoids: tiny wasps and flies that lay eggs on or inside a pest at a certain stage of development and feed on the pest.</p> <p>Pathogens: when pest populations grow large, diseases that infect certain pests often kill most of them.</p>
What do adult <b>lady beetles</b> ( <i>aka</i> ladybird beetles or ladybugs) look like?		Adults range from 1/32 to 3/8 inch with oval-shaped bodies. Many are reddish-orange with black dots; some are black with orange-red or yellow spots, and some are even all black.
Do the larve of lady beetles look much like the adults?		<p>No, not at all... Think of them as tiny, brightly colored alligators, somewhat flat and covered with spines.</p> <p>Both adults and larvae feed on many soft-bodied insects such as aphids.</p>
How much can lady beetles really control pests?		Each single beetle (larvae and adult)—depending on the species—consumes thousands of aphids and other small insects across their lifespan.
Has anyone seen a <b>green lacewing</b> ? What do they look like?		Adults are pale green with netted wings; 1/2 to 3/4 inch long. (Notice them around your porch lights on summer nights.) Adults don't feed on other insects—but larvae do.
What do lacewing larvae look like?		Larvae grow to 3/8 inch long. Larvae are spindle-shaped—fat in the middle, skinny at the ends—and creamy with brown markings. They have pinchers and eat aphids, spider mites, small caterpillars, thirps, and leafhoppers.
<b>Syrphid fly</b> adults mimic what other insect?		Bees—and they feed on pollen and nectar, too. Sometimes called hover or flower flies. Adults aren't predators—but larvae are.
What do syrphid fly larvae look?		Maggots or slugs (no legs). They vary from whitish cream to green or brown and range from 1/4 inch to 3/4 inch long. They pierce aphids with their hollow, hooked mouthparts to suck out body fluids.

<p>What do <b>ground beetles</b> look like?</p>	<p>Adults look flat and sometimes elongate; 1/16 to 1-3/8 inch long. Note hard, shell-like wing covers with parallel lines running lengthwise. Most adults are black, but many are colored with, green, purple, reddish, metallic blue or other bright markings.</p> <p>Ground beetles are predators of many insects (both bad guys and good guys). Recently, some species have been seen eating weed seeds among field crops—also a form of biocontrol.</p>
<p>What are “<b>true-bug</b>” predators?</p>	<p>Several predatory “true bugs” feed on aphids, spider mites, leafhoppers, small caterpillars, and insect eggs. Both adult and nymphs have piercing or sucking mouthparts, which they inject into prey, then suck out their fluids.</p> <p>Nymphs of true bugs look like adults—but without wings. True bugs vary in size from very small to 1½ inches.</p> <p>Damsel bugs, assassin bugs, big-eyed bugs, and minute pirate bug are some of the more common predatory bugs you’ll find in field crops.</p>
<p>What are <b>parasitic wasps and flies (parasitoids)</b>?</p>	<p>Parasitic wasps (many species) vary from .001 inches to as long as 1½ inches and are brown or black. Adults place eggs in or on insect hosts. As each larva develops, it lives in or on that host, killing it.</p> <p>Most parasitoids are like little smart bombs looking for a specific insect pest. Many only infect a certain stage of certain species of pests (or other insects)—and don’t bother us, our livestock, or our pets. Some flies are parasitoids, too.</p>
<p>How do <b>pathogens</b>—disease agents—help control pests?</p>	<p>Insect pathogens are at their best when the pests they infect reach large populations on a crop. For example, when soybean aphids reach high infestations, several “entomopathonic” diseases control them. One problem—they’re unpredictable as to when they occur.</p>
<p><b>Look for natural enemies on the field. If you don’t find any, view pictures in a soybean field guide. Show people what they’re looking for and explain the importance of natural biological control.</b></p>	

<p>Tips for conserving beneficial organisms...</p>	<ul style="list-style-type: none"> <li>▪ Know the difference between beneficial organisms and insect pests.</li> <li>▪ Use thresholds so you apply insecticides only when a pest will cause economic losses.</li> <li>▪ Where possible, use selective insecticides that kill just the pest and protect beneficial organisms.</li> <li>▪ Preserve good habitat for beneficial organisms. <ul style="list-style-type: none"> <li>➤ Field edges, hedge rows, flowering plants, and water are habitat that conserve beneficials.</li> <li>➤ Many flowering plants provide pollen and nectar for beneficial organisms.</li> </ul> </li> <li>▪ Remember predators and parasitoids can lag behind the pest population. Natural control lends a hand but will not always keep a pest population at low levels.</li> <li>▪ Use all the IPM tools that are available, correct identification of the organisms, monitoring, action thresholds, cultural controls, mechanical controls, beneficial organisms, and when necessary chemical controls</li> </ul>
<p><b>Look for beneficial organism in the field. Also look for signs of biocontrol at work, like aphid mummies, predators eating insects, and diseased insect pests.</b></p>	

## References

Soybean Insect Pests: North Carolina Cooperative Extension Service  
[http://ipm.ncsu.edu/soybeans/insects/insects\\_soybeans.html](http://ipm.ncsu.edu/soybeans/insects/insects_soybeans.html)

Iowa State University Soybean Disease and Pest Management Field Guide.

Soybean Pest Management: Bean Leaf Beetle  
<http://extension.missouri.edu/publications/DisplayPub.aspx?P=G7150>

Bean Leaf Beetle: *Cerotoma trifurcata* Forster  
<http://www.entm.purdue.edu/fieldcropsipm/insects/beanleafbeetle.html>

Two-spotted Spider Mite  
<http://ohioline.osu.edu/icm-fact/fc-24.html>

Weekly Field Crops Pest Report  
<http://nysipm.cornell.edu/fieldcrops/tag/pestrpt/default.asp>

Managing Two-Spotted Spider Mites on Soybeans and Corn in Minnesota  
[http://www.soybeans.umn.edu/pdfs/2009/2009\\_08\\_05\\_ManagingSpideMitesCornSoybean.pdf](http://www.soybeans.umn.edu/pdfs/2009/2009_08_05_ManagingSpideMitesCornSoybean.pdf)

Mexican Bean Beetle

*Epilachna varivestis* Mulsant, Coccinellidae, COLEOPTERA

[http://ipm.ncsu.edu/ag271/soybeans/mexican\\_bean\\_beetle.html](http://ipm.ncsu.edu/ag271/soybeans/mexican_bean_beetle.html)

Mexican Bean Beetle

*Epilachna varivestris*

[http://ipm.illinois.edu/fieldcrops/insects/mexican\\_bean\\_beetle/index.html](http://ipm.illinois.edu/fieldcrops/insects/mexican_bean_beetle/index.html)

Soybean Pest Management: Bean Leaf Beetle

<http://extension.missouri.edu/publications/DisplayPub.aspx?P=G7150>

Common name: Mexican bean beetle

Scientific name: *Epilachna varivestis* Mulsant (Insecta: Coleoptera: Coccinellidae)

[http://entomology.ifas.ufl.edu/creatures/veg/bean/mexican\\_bean\\_beetle.htm](http://entomology.ifas.ufl.edu/creatures/veg/bean/mexican_bean_beetle.htm)

Purdue University Corn & Soybean Field Guide 2009 Edition

ID-179

Mexican bean beetle *Epilachna varivestis* Mulsant, Coleoptera: Coccinellidae

University of Rhode Island Landscape and Horticulture Program

<http://www.uri.edu/ce/factsheets/sheets/mexbeanbeetle.html>