Garden Pesticide Practices & IPM for Pesky Insects, Weeds and more…

Merryspring Nature Center, March 25, 2025

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MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Photo: Gary Fish ☺

What is a pest?

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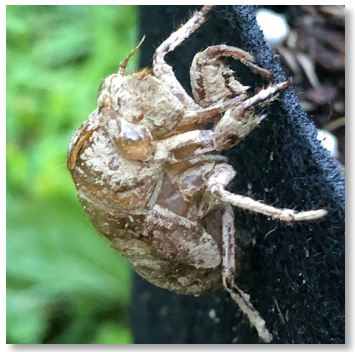
Beneficial **Neutral** **Incidental Pests** **Low Damage** **High Damage**



Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Sources: UNM Extension Caterpillars on Ornamental Plants; Photos: John Jemison, Bugwood.org – Steven Katovich, Clemson University, Roger Rittmaster

What is integrated pest management?

Identification

- Proper identification of pest
- Understanding the system where the pest exists

Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success

Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!

Action Thresholds

- What is the population level?
- What methods are needed at this level?

Biological and Pesticide Control

- Dynamic and flexible as methods change

IPM is the standard, and many institutions are involved

USDA

Northeastern IPM Center

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The IPM Cycle

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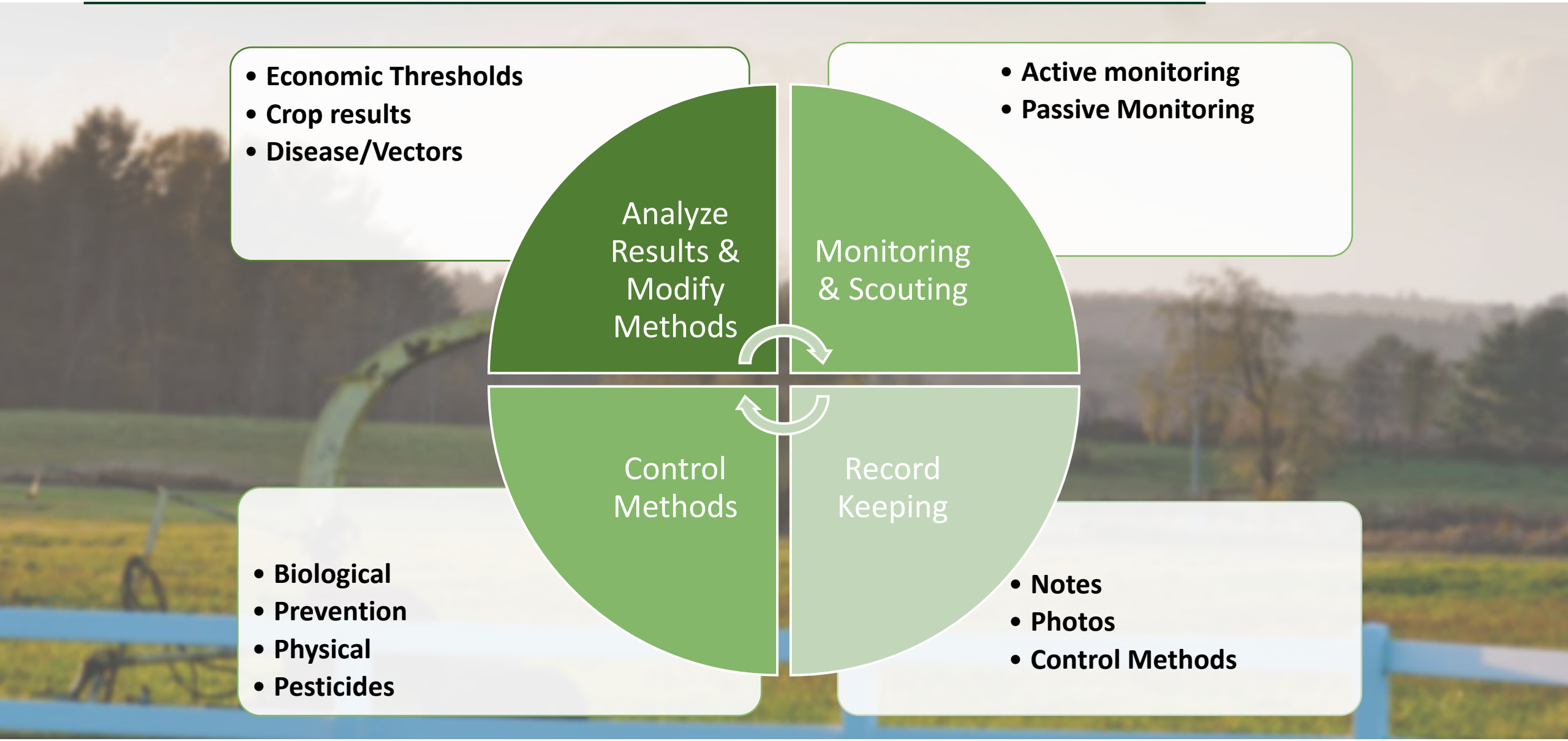

IPM is an Ever-Evolving System – Internally and Externally!

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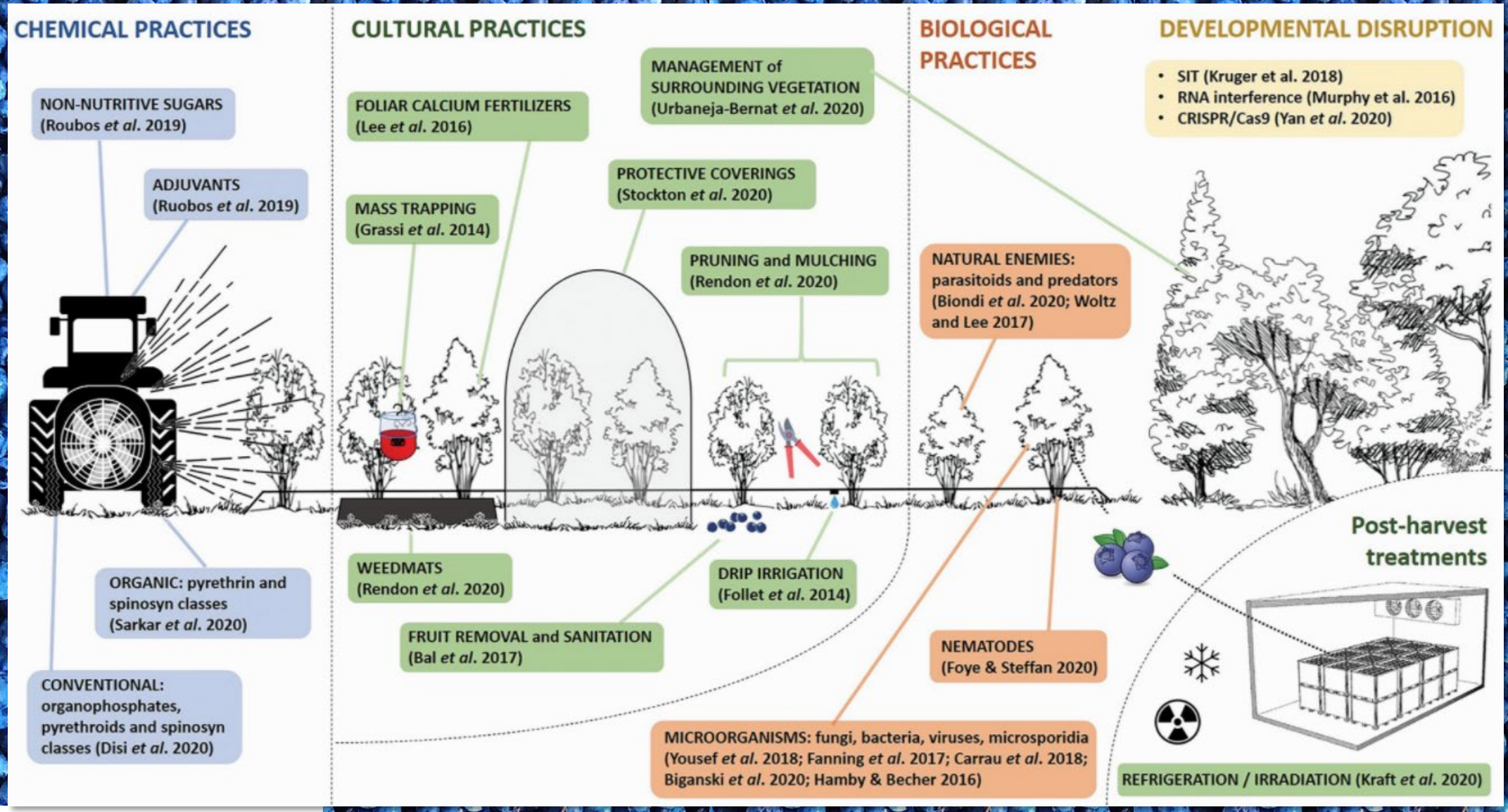

Figure: Tait et al. 2021 (Open Access Review Paper)

Organisms & life histories are COMPLICATED!

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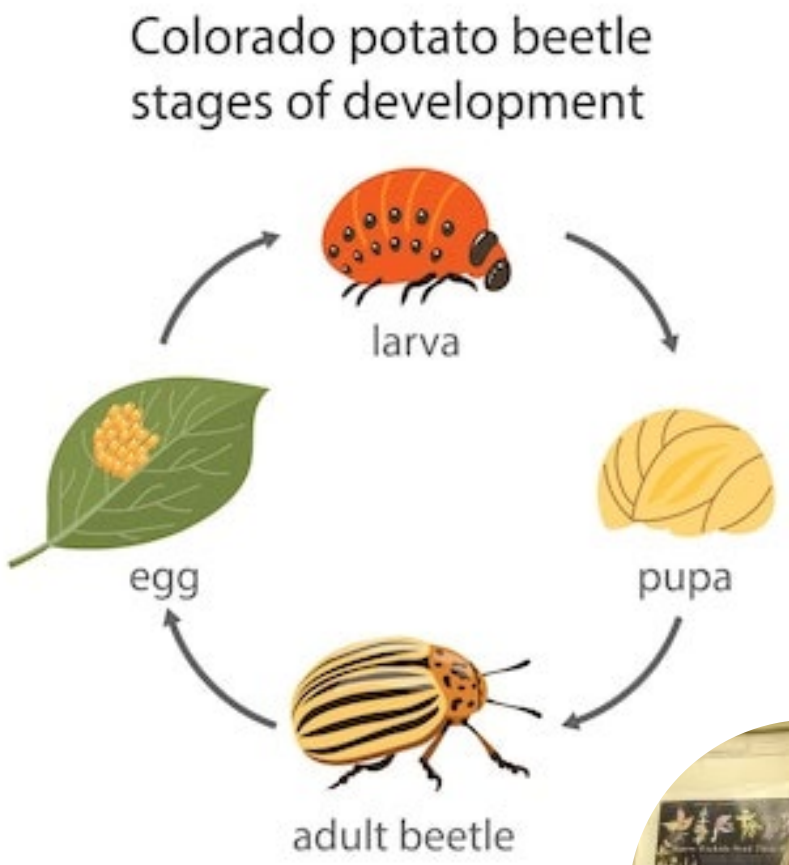

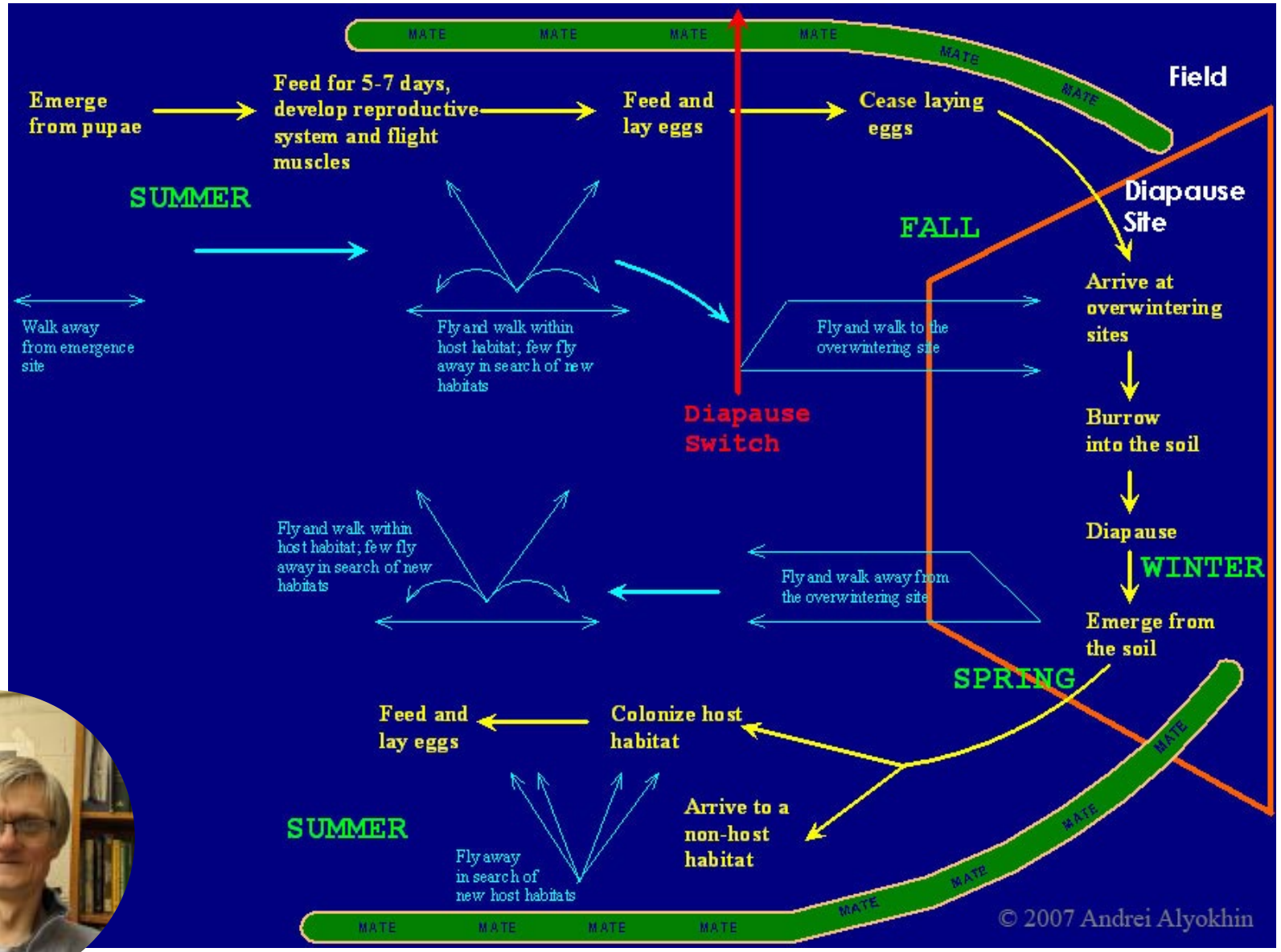

Images: FreePik, Andrei Alyokhin at www.potatobeetle.org

What is an Action Threshold?

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"Decide … the level of pests/damage when you will implement a management action to control the pest population."

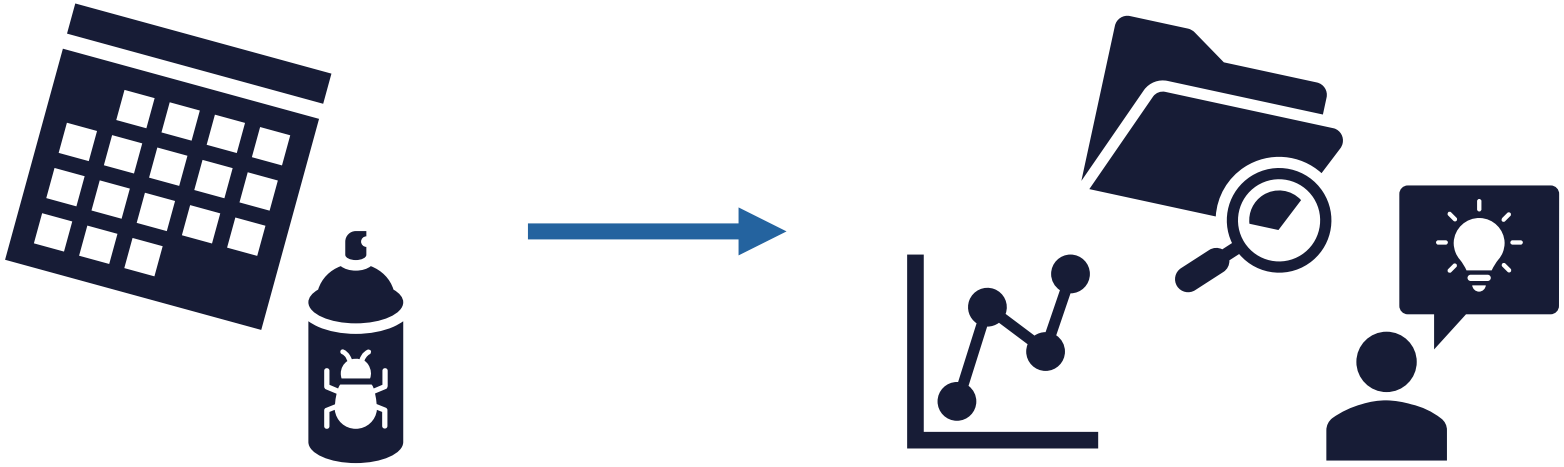

Photo: Joy (CC by 2.0); Quote: National Roadmap for Integrated Pest Management

What is an Action Threshold?

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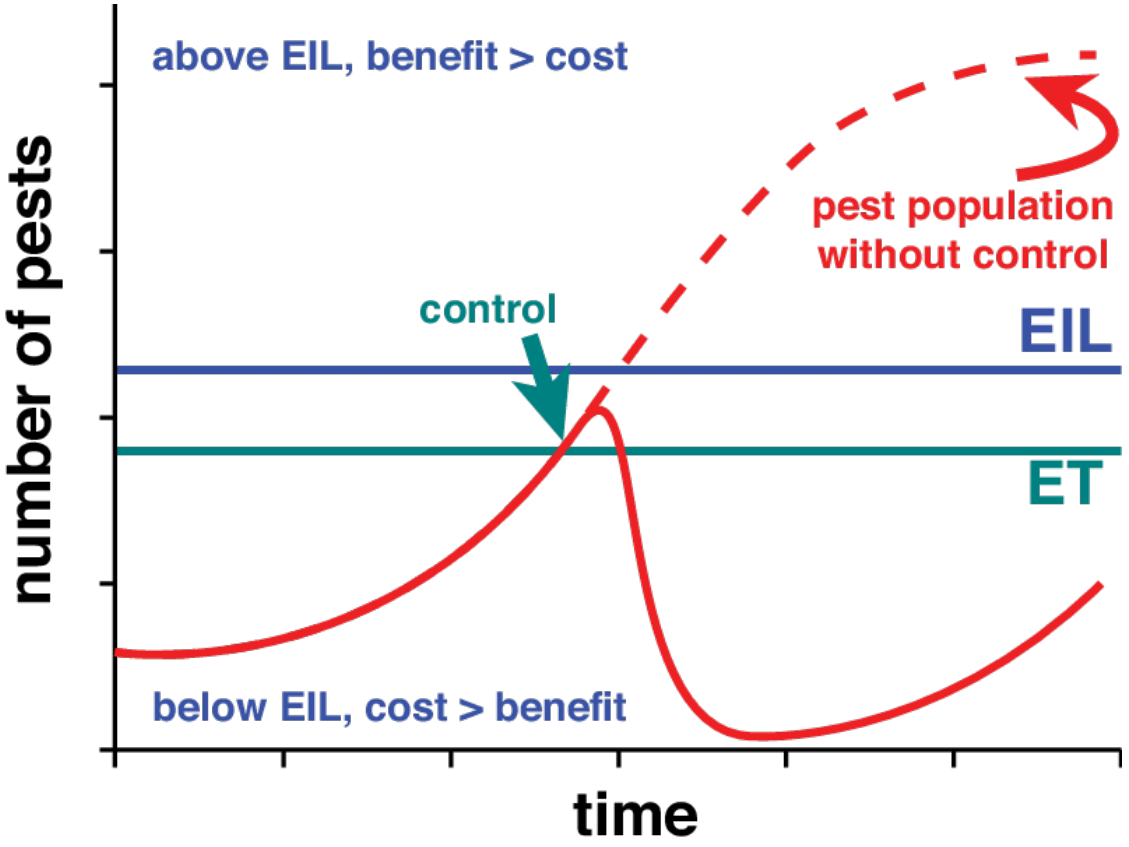
"Decide … the level of pests/damage when you will implement a management action to control the pest population."

Site-specific self-determined thresholds ⟷ Industry Monitoring & Action Threshold Standards

Low Value Crop ⟷ High Value Crop

Photo: Joy (CC by 2.0); Quote: National Roadmap for Integrated Pest Management

What is an Action Threshold?



Economic Injury Level
Crop loss is more expensive than controlling the pest

Economic Threshold
Pest abundance or damage level that will exceed EIL if not treated

Photo: Joy (CC by 2.0)

Monitoring & Recordkeeping

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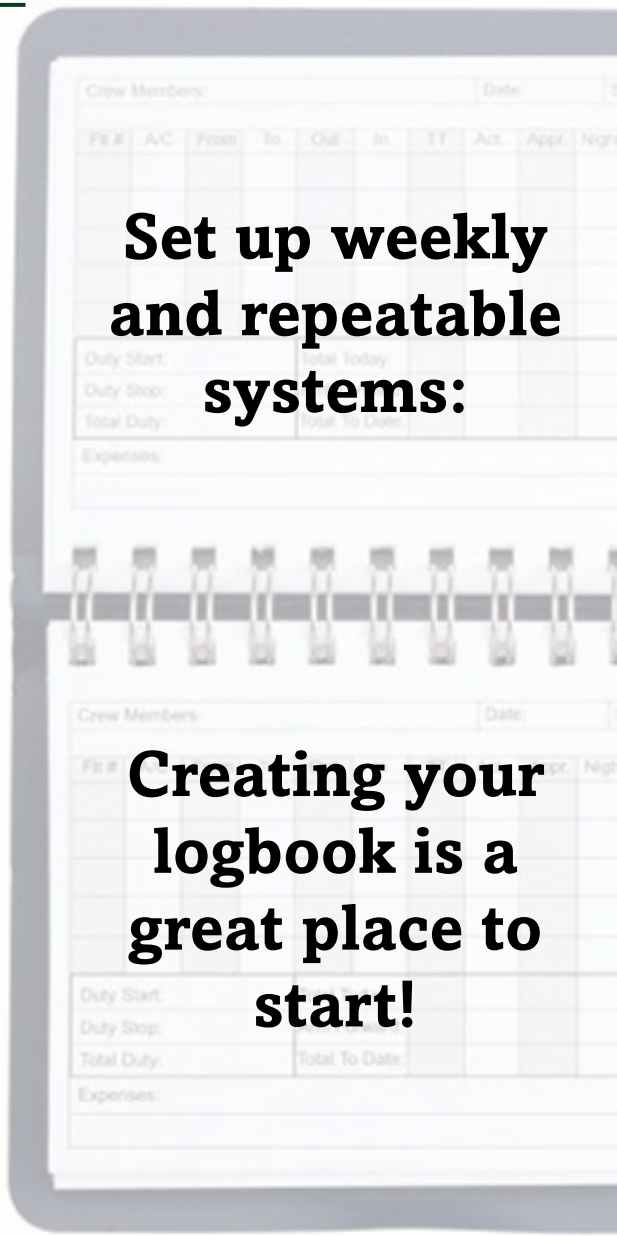
Date	Time	Initials	Crop Location	Observation Type	Description	*Many options…*

- **Visual scouting** – a big box to write in all pests seen or many columns with pest species
- **Passive Monitoring** – traps with unique identifiers, and columns with pest species
- **Control methods** – keep track of biocontrol releases, fertigation, watering, planting dates…etc.!



Set up weekly and repeatable systems:

Creating your logbook is a great place to start!

What products are NOT pesticides?

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Traps & Monitoring Tools

- Rodent traps
- Pheromone baited traps (e.g. Japanese beetle bags)
- Sticky traps
- Mechanical methods – hand picking, vacuuming, etc.
- Bug zappers (do NOT recommend!)

Exclusion Methods & Tools

- Solarization
- Row covers & insect netting

Beneficial Nematodes, Insects & Mites

- Living organisms that hunt and infect pests **naturally**
- Do not require EPA registration
- Must be kept alive and handled properly
- Do not persist long-term without pests to feed on

What about microbial biopesticides??? (e.g. Beauveria bassiana)

- This **is considered a pesticide!**
- Formulated and sold commercially
- EPA-registered – sold as a commercial insecticide
- Persists on plant surfaces after application

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to any specific product.

Biological Control

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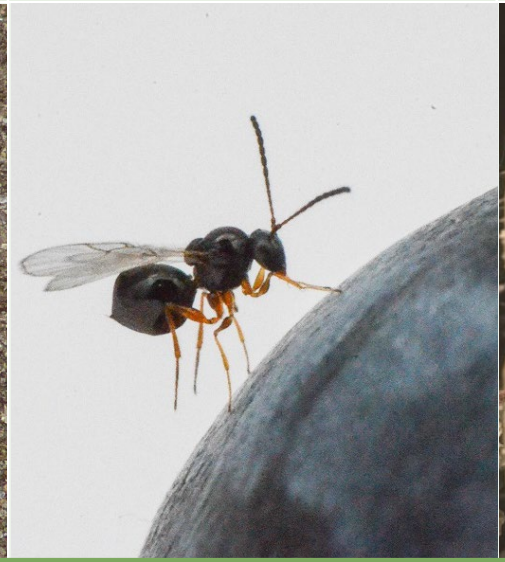
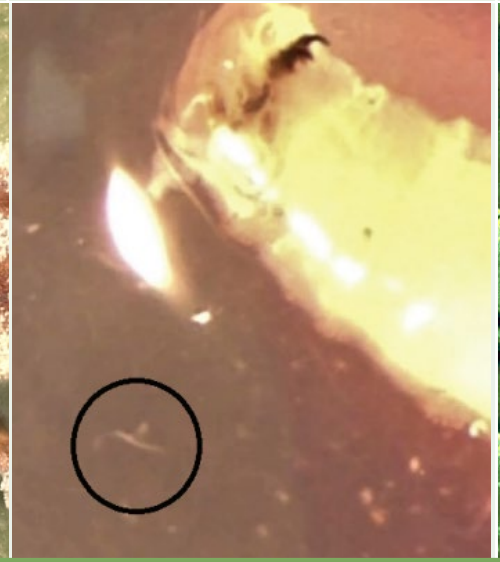
Often Insects or Other Non-Insect Arthropods		Entomopathogens		
Predators *e.g., rove beetles*	**Parasitoids** *e.g., larval parasitoids*	**Fungi** *e.g., Beauveria bassiana*	**Nematodes** *e.g., Oscheius onirici*	**Bacteria & Viruses** *e.g., Bacillus thuringiensis (Bt)*





Generalist → **Specialist**

Photos: Machi (iNaturalist); Tim Haye; Surendra Dara; Foye and Steffan 2019; Scimat

Biological Control

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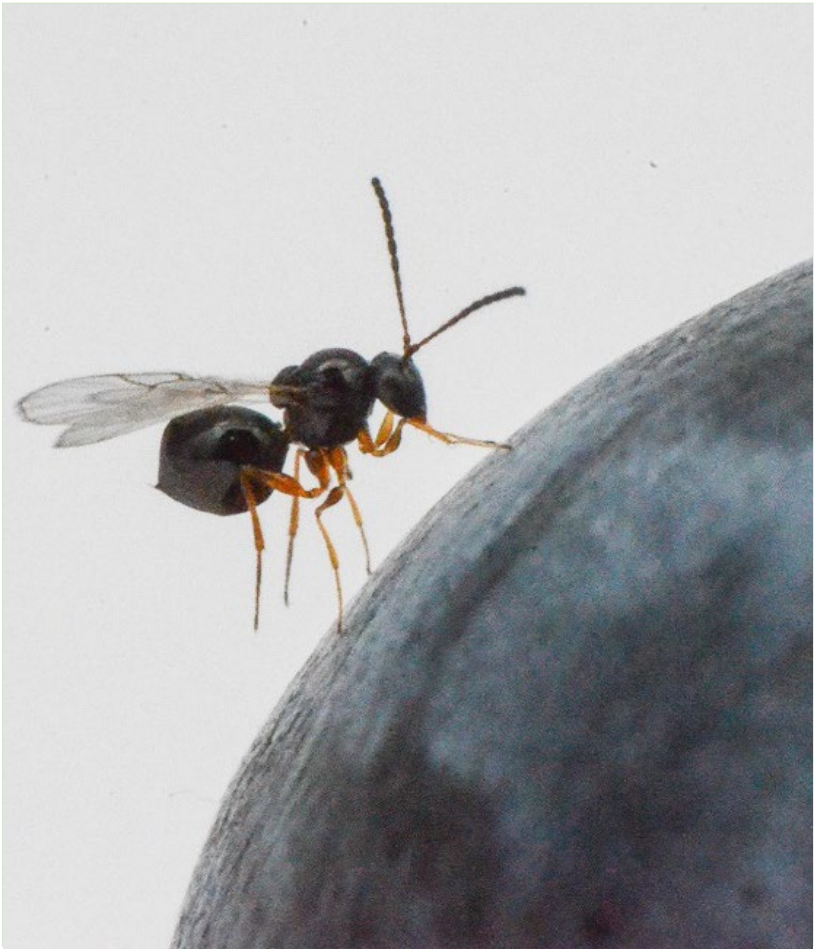
Conservation Biocontrol	Augmentative Biocontrol	Classical Biocontrol
		

Photos: Sarah Foltz (Xerces.org); Victor Fursov; Tim Haye

Releasing Biocontrol Organisms in Maine

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Check the Maine Unrestricted List

"Maine law allows the Department to maintain a list of species of fish and wildlife, including tropical fish and invertebrates, which do not require an importation, exhibition, or possession permit"

UNRESTRICTED SPECIES

Actinopterygii (Ray-finned Fishes)

Atheriniformes (Silversides)

Scientific Name	Common Name
Bedotia geayi	Madagascar Rainbowfish
Melanotaenia boesemani	Boeseman's Rainbowfish
Melanotaenia maylandi	Maryland's Rainbowfish
Melanotaenia splendida	Eastern Rainbow Fish

Beloniformes (Needlefishes)

Scientific Name	Common Name
Dermogenys pusilla	Wrestling Halfbeak

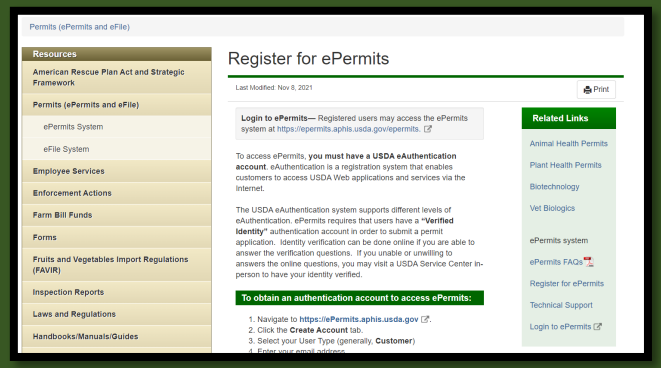
Characiformes (Piranhas, Leporins, Piranhas)

Scientific Name	Common Name
Abramites hypselonotus	Highbacked Headstander
Acestrorhynchus falcatus	Red Tail Freshwater Barracuda
Acestrorhynchus falcirostris	Yellow Tail Freshwater Barracuda
Anostomus anostomus	Striped Headstander
Anostomus spiloclistron	False Three Spotted Anostomus
Anostomus ternetzi	Ternetz's Anostomus
Anostomus varius	Checkerboard Anostomus
Astyanax mexicanus	Blind Cave Tetra
Boulengerella maculata	Spotted Pike Characin
Carnegiella strigata	Marbled Hatchetfish
Chalceus macrolepidotus	Pink-Tailed Chalceus
Charax condei	Small-scaled Glass Tetra
Charax gibbosus	Glass Headstander
Chilodus punctatus	Spotted Headstander

Link to the Unrestricted List
Link to Learn More

Get a permit from APHIS

"Under the authority of the Plant Protection Act of 2000, a Plant Protection and Quarantine (PPQ) 526 permit is required for the importation, interstate movement and environmental release of biological control organisms of plant pests and weeds."



Link to register for ePermits

Get a permit from the Maine Department of Inland Fisheries and Wildlife

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
353 Water Street, 41 SHS Augusta, ME 04333
Phone 207-287-5261

Wildlife Importation Permit Application
For Category 1 Restricted Species

In accordance with the provisions of the Revised Statutes, Title 12, Section 12152, 3-D.A. 1 hereby apply for a permit that allows me to import wildlife that is threatened or endangered, or that presents a risk to humans into the State.

Application Fee: $250
Permit Fee: $27

Name of Company/Facility: _____

Name of Owner/Manager: _____ **Date of Birth:** ___/___/___

Mailing Address: _____
(P.O. Box/Street/Apt#) (City/Town) (Zip Code)

Physical Address: _____
(Number, Street/Road Name/Apt#) (City/Town) (Zip Code)

Email Address: _____ **Phone Number:** (___) _____

List species you request to import below (***Please note:*** *you must provide a certification of veterinary inspection valid for the entire time animal(s) will be in the State, as well as other required documentation – see next page for details)*

Common Name	Scientific Name	Gender	Number

Do you possess a current Wildlife Exhibition Permit for the Category 1 Restricted Species listed above? ☐ Yes OR ☐ No

Date of Import: _____ **Import Method:** _____

Source (only one source per application): _____
(Name) (Address: Street, City, State, Zip)

Are species listed on CITES Appendix 1, or the USFWS Endangered Species list? ☐ Yes or ☐ No

Describe your experience handling species listed above: _____

Link to the Wildlife Importation Permit Application

What is integrated pest management?

Identification

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Identification: Overview & Considerations

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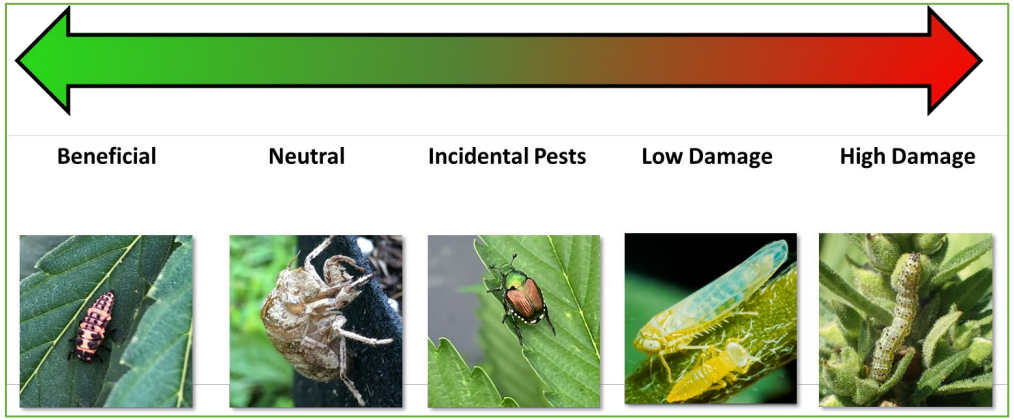
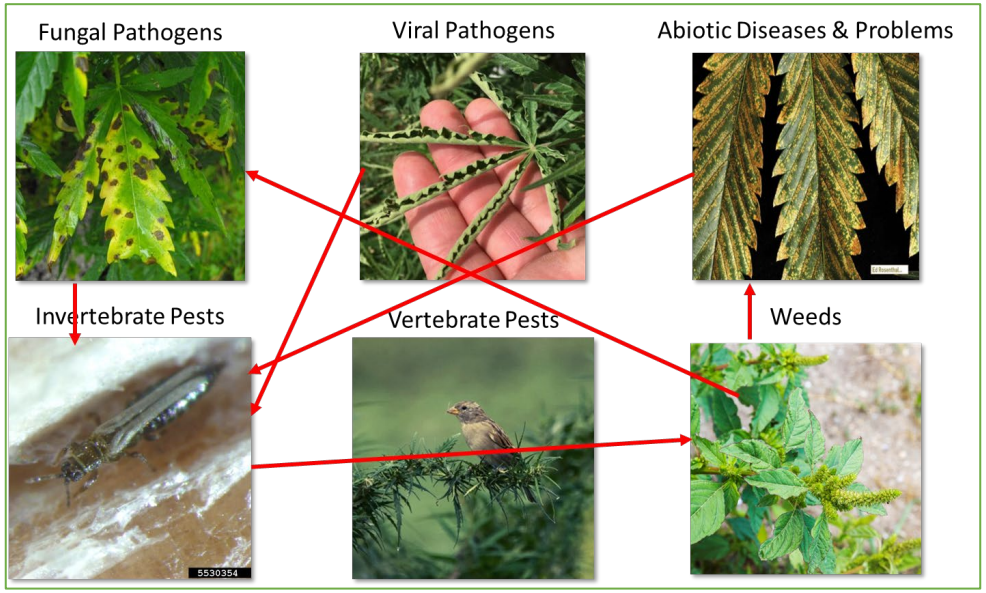
Without proper identification, you cannot understand the organism or problem you are having with your garden.

Imagine trying to treat a broken arm without knowing that your arm is broken. What types of mistakes could you make?





MAINE IPM COUNCIL
INTEGRATED PEST MANAGEMENT

Colorado Potato Beetle ("Potato Bug")

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Adults (Year-Round)

- Adults overwinter under the soil
- Emerge in the spring to feed and mate
- Females capable of laying up to 600 eggs

4-5-week period

Eggs (May-Sept)

- Typically laid on the underside of a leaflet
- Egg masses with 15-40 eggs per mass

4-10 days

Larvae (June-Oct)

- Small larvae feed on tender new growth
- "Slug-like" appearance
- Can eat 40 cm^2 potato leaves per day!

2-3 weeks

Pupae (July-October)

- Pupate in the soil below plants where they fed

5-10 days

1-3 generations per year

First discovered in the Rocky Mountains on buffalo bur!

Key Problems

- Damage can reduce yield and kill plants
- Has developed resistance to many insecticides
- Feeds on potato, pepper, eggplant, tomato, nightshade, and more!

Sources: UMaine Extension, Maine Potato IPM Program, www.potatobeetle.org; Photos: David Cappaert, imarsman , Giuseppe Mazza

Colorado Potato Beetle

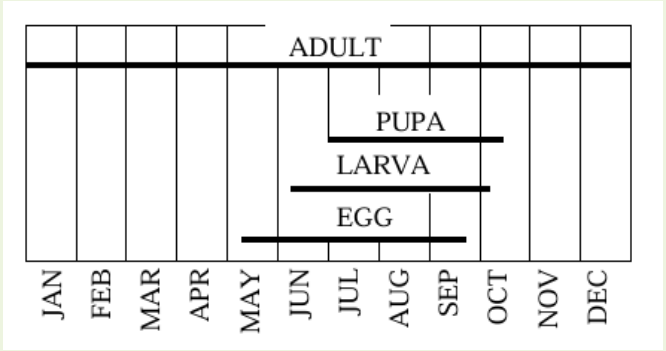
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Colorado Potato Beetles

- **Adults**: 3/8 inch long, 1/4 inch wide; 10 alternating yellow and black stripes
- **Larvae**: orange / red in color, distinctive black spots along the side

Monitoring & Plant Damage

- Begin monitoring every 2-3 days for **adults** in early spring
- Look at crop plants and weeds
- If adults found, search for eggs and larvae on the underside of leaves
- **Beat sampling:** place a drop cloth under plant, tap and look for insects falling off



When to Take Action & Control Options

- Established economic thresholds:
  - Avg. 25 adults/50 plants
  - Avg. 200 sm larvae/50 plants
  - Avg. 75 lg larvae/50 plants

- Hand pick adults, eggs, and larvae and drop into a bucket of soapy water
- Small hand-held vacuum cleaner
- Remove all life stages

- For farms: several more options laid out in detail on Andrei's website here!

Sources: UMaine Extension, Maine Potato IPM Program, www.potatobeetle.org; Photos: David Cappaert, imarsman , Giuseppe Mazza

Colorado Potato Beetle

When garden is limited to a few potato, tomato, or eggplant plants, hand-picking overwintered adults and egg masses early in the season is the simplest management approach…

…It is no more time-consuming than other gardening practices, does not require expensive purchased inputs, and environmentally friendly. **It can also be a relaxing and somewhat therapeutic experience – after all, from the biological point of view we have evolved to be hunters and gatherers, not computer programmers or hedge fund managers…**

The picking should be done for several weeks because overwintered beetles exit diapause and colonize host plants over approximately one-month time window.

Sources: www.potatobeetle.org

Striped Cucumber Beetle

Adults

- Adult feed inside flowers, preventing pollination and fruit set
- Unmated adults overwinter under leaves and other debris

7-10 days

Pupae

- Mature larvae pupate in the soil

2-6 weeks

Eggs

- Eggs are laid in the soil

8-10 days

Larvae

- Larvae feed and can cause severe damage to roots

1-3 generations per season

Beetles will even feed on the rind of produce!

Key Problems

- Damaging on cucurbits: squash, cucumber, melon, and pumpkin
- Spread diseases including bacterial wilt, cucumber mosaic virus, and squash mosaic virus

Sources: UMaine Extension; UNH Extension; Maine DACF; MOFGA; Photos: David Cappaert, Whitney Cranshaw, Gerald Holmes;

Striped Cucumber Beetle

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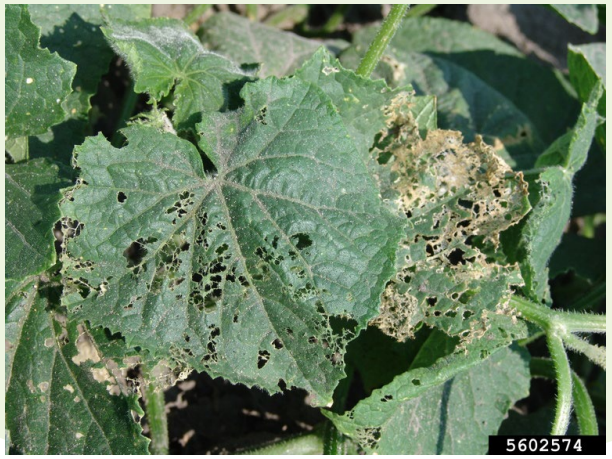
Identifying Cucumber Beetles

- Adults: 1/5th inch, black head, yellow-green wing coverings, three black stripes
- Larvae: 1/3 inch, dark on each end

Monitoring & Plant Damage

- Look for adults emerging and feeding on willow, apple, goldenrod, and more in the spring (when soil temps reach 55°F)
- Adults will move to cucurbits as soon as available
- Search for adults in the early morning, look for damage on young leaves and in flowers



When to Take Action & Control Options

- Check cucurbits **daily** for adults & hand pick
- Beetles can arrive daily, it can feel frustrating to see them again and again- keep going! ☺
- Rotate cucurbit crops to a new spot each year
- Plant wilt-resistant varieties
- Remove plant debris from the garden
- Barriers or row covers can help, remove by midsummer to allow pollination to occur
- Remove alternative hosts nearby, including goldenrod and aster

***Sources:** UMaine Extension; UNH Extension; Maine DACF; MOFGA; **Photos:** David Cappaert, Whitney Cranshaw, Gerald Holmes;*

Striped Cucumber Beetle

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Photos: Art Cushman, Whitney Cranshaw;

Japanese Beetles

Adults

- Emerge around the start of July, live for up to 40 days
- Typically produce 40-60 eggs in lifetime

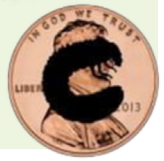
Eggs

- Eggs laid individually in turf 15-20cm below soil surface

2 weeks

Larvae

- Feed from late July through August
- Hard frosts – deeper to soil, overwinter (year 1)
- Feed (year 2) from May through mid-June



1-3 weeks

Pupae

- Pupate in mid-June after feeding for 4-8 weeks once soil temps reach around 50°F

Development is temp dependent

Accidentally introduced in New Jersey in 1916

Key Problems

- Adults feed on foliage and fruits of hundreds of species
- Grubs feed on roots of many plants and grasses, often destroying turf

Sources: GotPests; UMaine Extension; DACF Grubs; Review Article (2022); Photos: Bugwood.org – Steven Katovich, Jon Yuschock, Whitney Cranshaw, Cornell Cals Grub ID Tool

Japanese Beetles

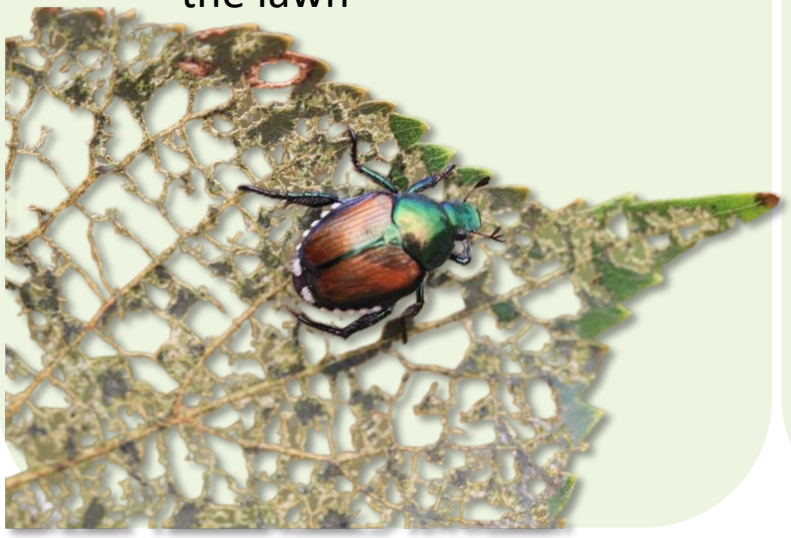
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Japanese Beetles

- **Adults**: ~1/2 inch, metallic green with copper brown wing covers; row of white hair tufts (6 per side)
- **Grub (larvae)**: ~1 inch when fully grown, C-shaped

Monitoring & Plant Damage

- Adults:
  - Feeding damage looks like lacy leaves – many holes, skeletonized
  - Feeds on over 400 plants
- Larvae
  - Skunks and crows digging up the lawn



When to Take Action & Control Options

- Combination of methods best
- Grubs – monitor for 8-10 per square foot, treat if found at this level; water grass!
- Adults – constant hand-picking or vacuuming
  - DO NOT KILL adults with white eggs…
- IF pheromone traps desired, place at least 50 feet away from protected plants. Empty before entirely full.
- *Some* evidence that beneficial nematodes work in the last three weeks of August work

Sources: GotPests; UMaine Extension; DACF Grubs; Review Article (2022); Photos: Bugwood.org – Steven Katovich, Jon Yuschock, Whitney Cranshaw, Cornell Cals Grub ID Tool

Japanese Beetles

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"In areas where the beetle is established, these traps are effective at detecting and monitoring populations rather than management, as they **typically attract more beetles than they capture**, leading to **increased feeding and damage** on nearby plants.

Deploying one or multiple traps resulted in much greater beetle defoliation of plants in residential landscapes compared with no traps.

This increase in beetle feeding damage results from the **spillover effect**, caused by the beetles being more attracted to the overall location than to the trap."

Source: Althoff and Rice 2022

Japanese Beetle Biocontrol

Winsome Fly

- Adult flies – 5mm
- Emerge one week before Japanese beetles and feed on nectar-producing plants
- Lay eggs on adult beetles
- Larvae hatch within a few days
- Serrated mouthparts: bore into adult beetle
- Feeds inside beetle for 3-4 days
- Beetles die within 5-10 days
- Overwinters inside of the beetle cadaver

Sources: DACF; University of Minnesota Extension; Images: UMaine Cooperative Extension; Jacques Lasnier; Beckadoodles; Bugwood.org – Whitney Cranshaw

Japanese Beetle Biocontrol

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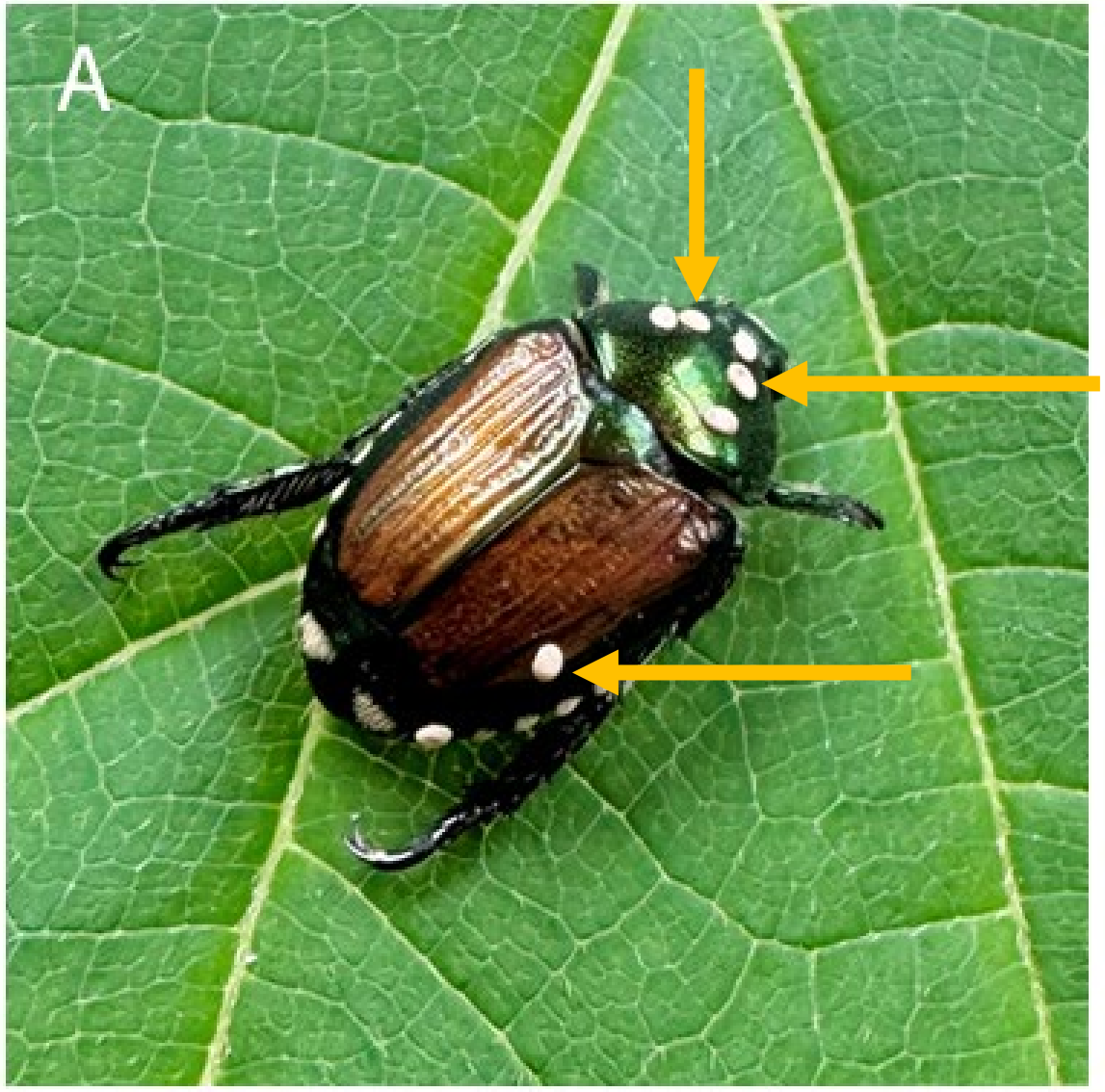

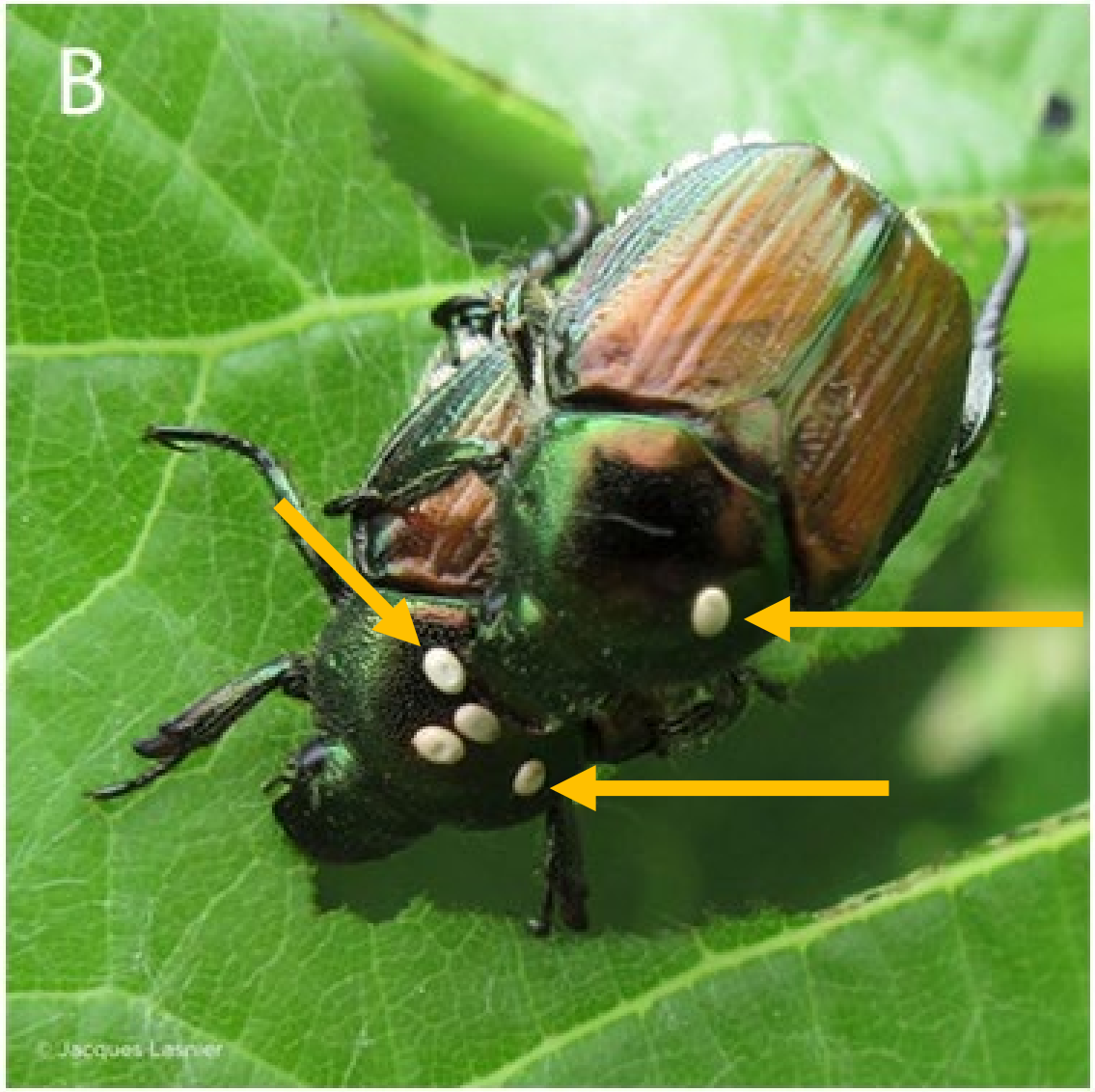

Sources: University of Minnesota Extension; Images: J.E. O'Hara

White Grubs: Knowing the species is crucial to control!

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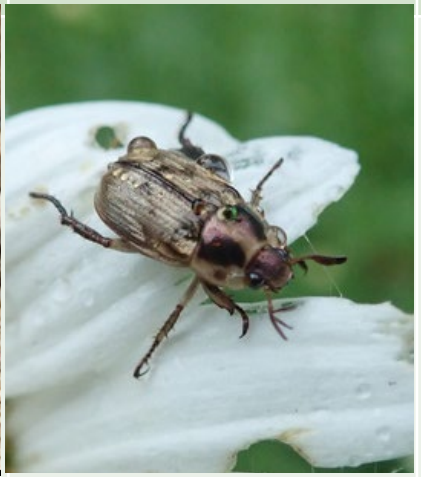
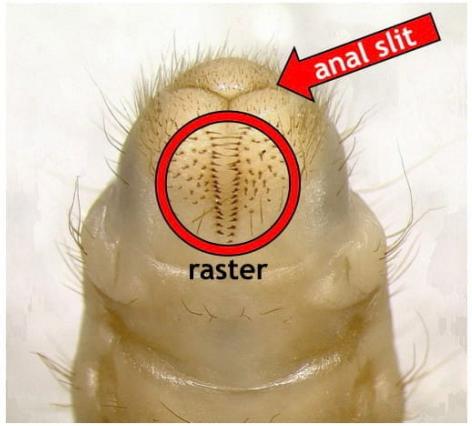
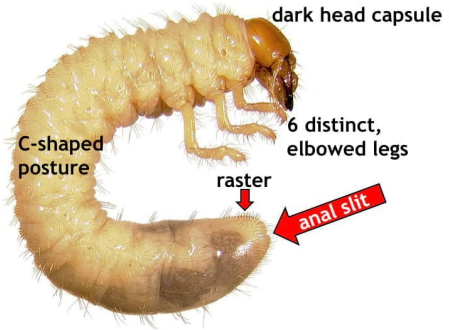
Japanese Beetles (*July 15 egg hatch*)	European Chafers (*July 1 egg hatch*)	June Beetles	Oriental Beetles (*July 15 egg hatch*)	Rose Chafers	Asiatic Garden Beetles (*Jul 1*)
					
					

Sources: Dave Shetlar (OSU); WSU; Bugwood.org – David Cappaert, Steven Katovich, Bruce Watt, Joseph Berger, Whitney Cranshaw, Jim Baker, Clemson University,

White Grubs





Sources: Dave Shetlar (OSU); WSU; Bugwood.org – David Cappaert, Steven Katovich, Bruce Watt, Joseph Berger, Whitney Cranshaw, Jim Baker, Clemson University,

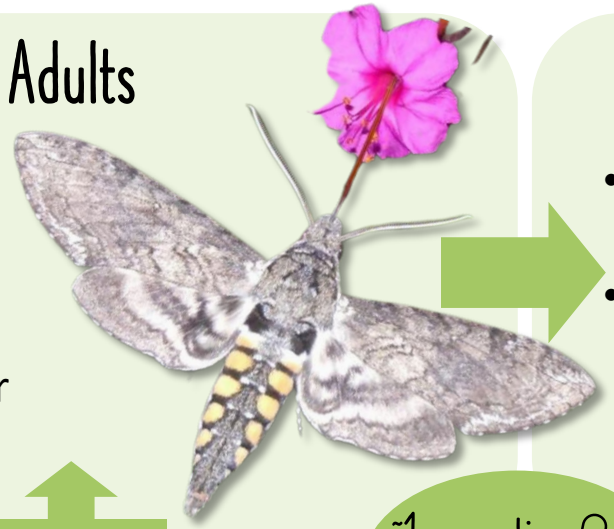
Tomato & Tobacco Hornworms

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Photos: Tobacco hornworms

Adults

- Adults emerge in late spring or early summer
- Typically called sphinx, hawk, or hummingbird moths



Overwinter

~1 generation per year

Eggs

- Vary in color from light green to white
- Deposited on top and bottom of leaves, more frequently the bottom

2-8 days

Larvae

- Typically, five instars

~20 days

Pupae

- Mature larvae drop to the soil, burrow 3-4 inches, and pupate

The tobacco hornworm is more likely to be seen in Maine gardens.

Key Problems

- Feed on solanaceous plants: tobacco, tomato, eggplant, pepper, potato, and some weeds
- Large caterpillars can strip a plant of foliage in a short period of time

Sources: UMaine Extension; DACF GotPests; Kansas State; UF Extension; UMass Extension ; Photos: Bugwood.org, Whitney Cranshaw, Art Cushman, Nancy Hinkle, John French, Joseph Berger, Robert Zimlich

Tomato & Tobacco Hornworms

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Hornworms

- **Adults:** Medium to large moths, mottled gray-brown, 4-5 inch
  Larvae: Horny spike on tail end, large caterpillars up to 4 inches long


Tomato Hornworm (Manduca quinquemaculatus)

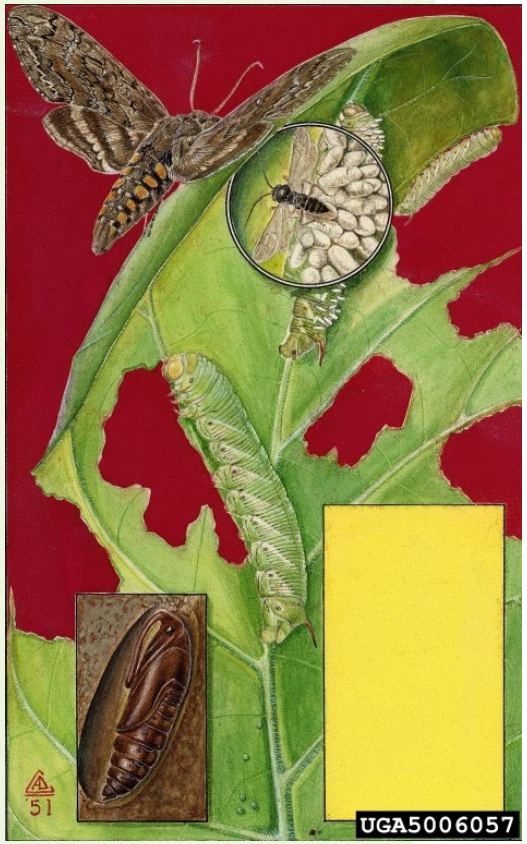

Tobacco Hornworm (Manduca sexta)

Monitoring & Plant Damage

- Surprisingly difficult to see
- Active at night
- Damage the leaves and stems of plants
- Leaves behind dark green or black droppings

When to Take Action & Control Options

- Hand pick into a bucket of soapy water, or feed to chickens
- If parasitoid cocoons are present, leave the caterpillar



Sources: UMaine Extension; DACF GotPests; Kansas State; UF Extension; UMass Extension ; Photos: Bugwood.org, Whitney Cranshaw, Art Cushman, Nancy Hinkle, John French, Joseph Berger, Robert Zimlich

Tomato & Tobacco Hornworm Scouting Trick

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to any specific product.

Source: Giant Veggie Gardener, Vansky UV Flashlight

Tomato & Tobacco Hornworm Biocontrol

Cotesia congregata

- Adult females inject eggs into caterpillars
- Parasitoid larvae bore into the host and feed on tissues inside caterpillars
- Chew through skin of host, emerge, and spin silk cocoons and pupate

- Adults emerge in about a week's time, and the caterpillar does not feed much during this week

- LEAVE CATERPILLARS!

Sources: NC State Extension; Photos: Alex Wild, Bugwood.org – Gerald Holmes

Cutworms (several species)

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying cutworms

- **Adults**: Typically brown or black moths with splotches or stripes on wings, 1.5 inch wingspan, darker forewing
- **Larvae**: Can be challenging to identify to species; smooth with few hairs, typically curl into a tight c-shape

Monitoring & Plant Damage

- Most caterpillars are nocturnal, **monitor in the morning** when damage is easier to see
- Monitor corn, peppers, tomatoes, and beans
- Look for plants that have been cut off, stunted, or killed

When to Take Action & Control Options

- Keep crop areas as weed-free as possible, especially in the fall and spring (moths are attracted to weeds for egg-laying)
- Till in the fall to destroy or expose overwintering pupae
- Hand-pick cutworms feeding on plants after dark
- Protect young plants with aluminum foil collars around the stems (pushed 1 inch into the ground)
- Apply insecticides in the evening

Sources: UMaine Extension; DACF Gotpests; UNM Extension; Photos: Bugwood.org - Whitney Cranshaw, W.M. Hantsbarger

Common Cutworms in Maine

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Army Cutworm	Black Cutworm	Variegated Cutworm






Photos: Whitney Cranshaw; W.M. Hantsbarger, Ian Kimber, Joseph Berger

Slugs & Snails

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Slugs & Snails

- Closely related mollusks (gastropods)
- Over 90 terrestrial gastropod species in Maine
- Gray garden slug is the most common in east coast gardens (photo)

Monitoring & Plant Damage

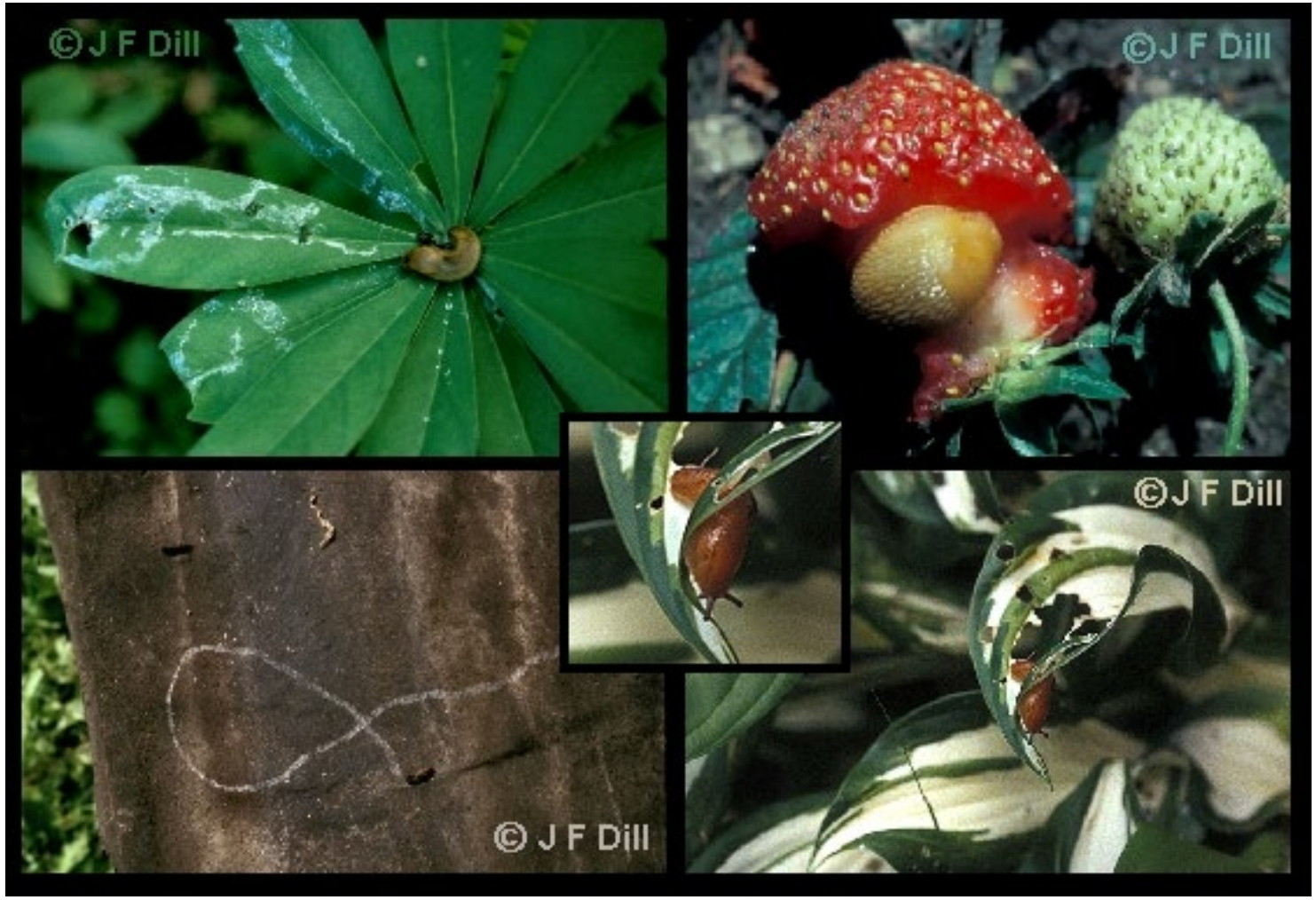
- Most active on wet/overcast days or at night
- Overwinter as eggs and adults, typically emerge at 32-40 F
- Look for:
  - Shiny slime trails on the ground
  - Damage to plants (be aware that it can mimic damage from other pests)
  - Slug eggs

When to Take Action & Control Options

- Remove damp hiding areas for slugs (unless willing to check daily)
- Improve drainage
- Copper barriers around garden (see MOFGA link below)
- Bare cultivated perimeter around garden
- Conserve predatory beetles
- Trap and drown slugs with beer traps (see UNM Extension link below).
- Place “traps” – horizontal boards, rocks, pots, etc. and check every morning for slugs and snails to remove into a bucket of soapy water

Sources: UMaine Extension; MOFGA; DACF Gotpests; UNM Extension; Photos: Joseph Berger, Matthew Boucher

Slugs & Snails



Sources: [MOFGA Website, Matthew Boucher](); Jim Dill (UMaine Extension)

Quackgrass

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Quackgrass

- Leaves are long, flat and tapered, and slightly hairy on the upper surface.
- Seeds grow on long, narrow spiked seed heads which are 3 to 8 inches long
- Stems are smooth and hollow and grow 1-4 feet tall.

Monitoring

- Seedlings emerge in spring into summer (shoots are more common)
- Shoots emerge from old rhizomes in early spring, and from new rhizomes in the late summer and fall
- **New shoots will appear after tilling or hoeing**
- Seed heads appear in July

When to Take Action & Control Options

- Hand removal is difficult
- Tillage can potentially make quackgrass worse by spreading rhizomes
- In small areas, rake up the surfaced rhizomes and remove them.
- If using herbicides, apply a targeted (spot-treatment) approach. This is one species that herbicides are the most likely solution.

Sources: DACF Gotpests; Cornell CALS; Photos: Bugwood.org - Robert Vidéki, University of Minnesota

Quackgrass

Sources: Bugwood.org – Steve Dewey, USDA Plants Database, Bruce Ackley

Potato Late Blight

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Potato Late Blight

- Brown, leathery spots form on green fruit, turning brown to purplish-black. In humid conditions, white mold appears.
- Black and brown spots appear on stems, spreading quickly, potentially killing entire veins in high humidity.
- Affected fruit often rots due to secondary bacteria and fungi.

Monitoring & Plant Damage

- Monitor potato and tomato plants, along with solanaceous weeds
- Disease overwinters in infected tubers in cull piles, infected volunteer plants, or seed
- Ideal conditions: nighttime temps in the 50s, daytime temps in the 70s, with rain, fog, or heavy dew

Late Blight is a very serious disease. If you suspect Late Blight in your garden, please contact the University of Maine Cooperative Extension, Pest Management Office at 800-287-0279

When to Take Action & Control Options

"Cultural control alone or chemical control alone will not provide adequate protection during the late blight epidemics"

- Plant certified seed free of late blight
- Eliminate cull piles and volunteer potatoes
- Control solanaceous weeds (esp. nightshade family)
- It is likely fungicides will be needed depending on timing

Sources: DACF Gotpests; UMaine Extension; Photo: Bugwood.org, Robert Wick

Potato Late Blight

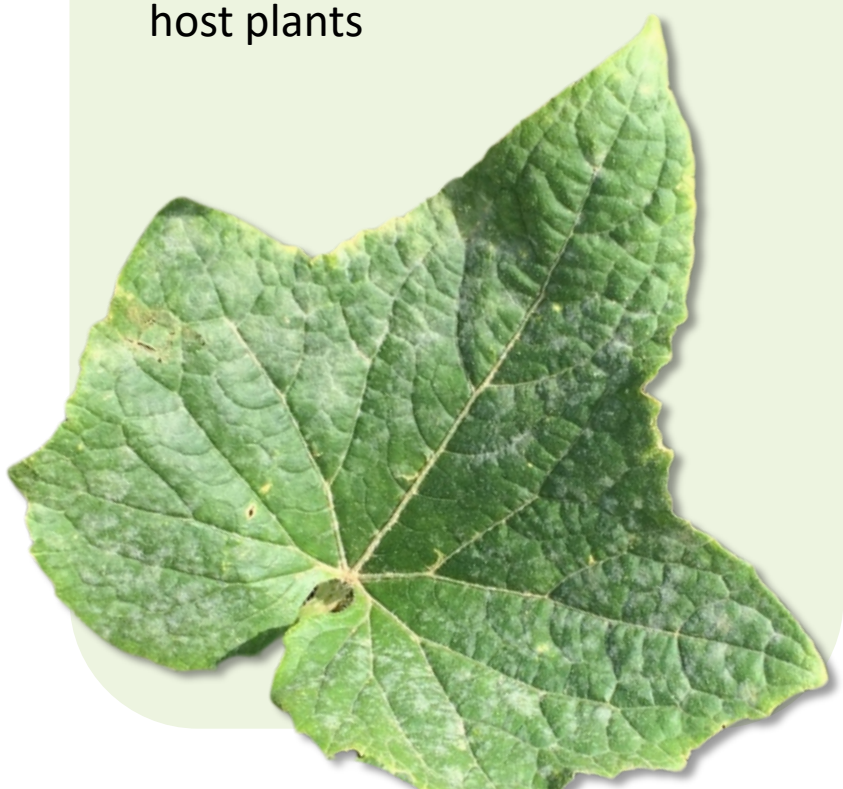
Sources: Bugwood.org – Metin Gulesci, Thirunarayanan Perumal, Gerald Holmes

Powdery Mildews

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Identifying Powdery Mildew

- Caused by a variety of fungi
- Patches of white fungal growth on upper lead surface
- Different species have different host plants



Monitoring & Plant Damage

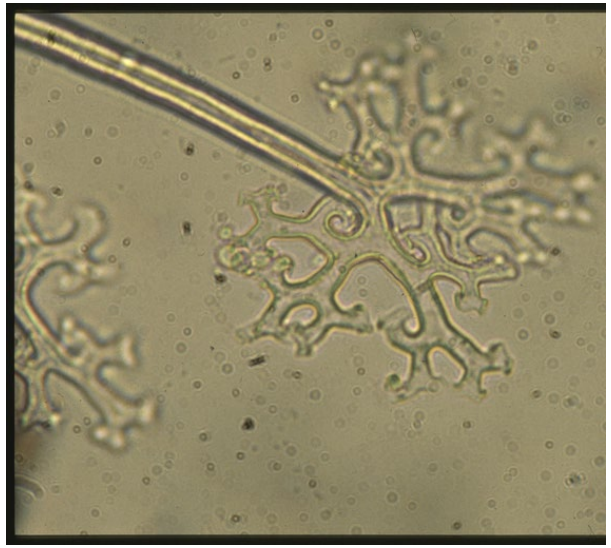
- Look for dwarfing and stunting of plant and deformation of flower buds and shoots.
- Scout:
  - upper and lower side of leaves regularly
  - for white powdery fungal patches on the undersides of older leaves

When to Take Action & Control Options

- Choose plants wisely: Plant resistant varieties.
- Use wider plant spacing spread.
- Prune to promote maximum air circulation and reduce relative humidity
- Remove infected leaves when symptoms are noticed
- Destroy infected plant material by composting or burial.

Sources: DACF Gotpests; Maine IPM Council; MOFGA; Photo: Rebecca A. Melanson

Powdery Mildews



Sources: Bugwood.org – Rebecca Melanson, Edward Sikora, Yonghao Li, PSU Plant Pathology

What is integrated pest management?

Identification

- Proper identification of pest
- Understanding the system where the pest exists

Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success

Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!

Action Thresholds

- What is the population level?
- What methods are needed at this level?

Biological & Pesticide Control

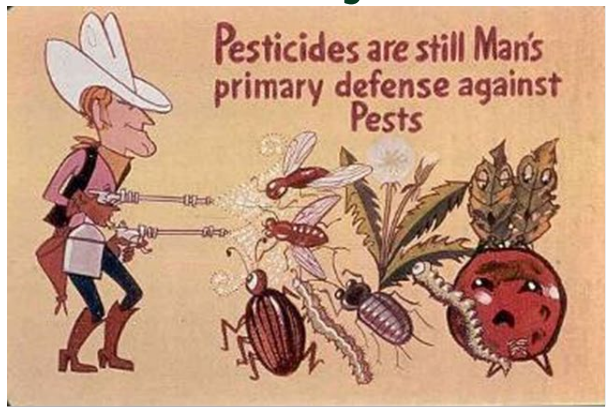
- Dynamic and flexible as methods change

IPM is the standard, and many institutions are involved

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

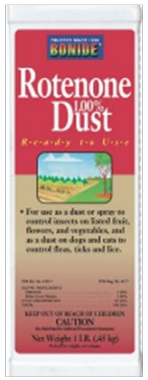
Pesticide Safety Practices



How we see ourselves using pesticides

All pesticides have risks!!!

- Organic ≠ Safe
- Synthetic ≠ Highly toxic
- Natural ≠ Safe



No endorsement intended or implied

Unfortunately, a not so uncommon result from our use of pesticides


boston.com

Bug spray likely killed infant, injured 2 in SC

By Seanna Adcox
Associated Press Writer / November 2, 2009

COLUMBIA, S.C.—Bug spray that produces a fog to kill insects is likely to blame for the death of a 10-month-old South Carolina boy, and his 2-year-old brother was critically injured by the fumes, authorities said Monday.

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to any specific product.

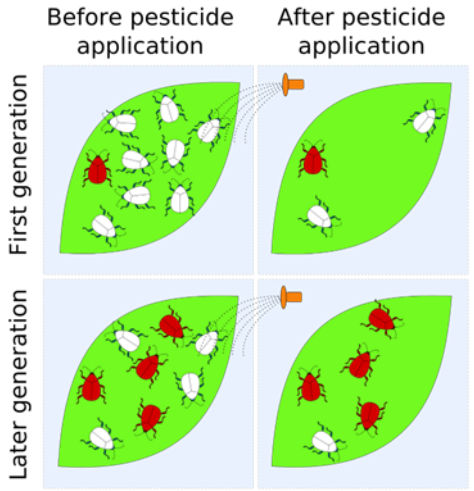
Source:

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Pesticide Safety Practices

- Over-reliance can end up in pest resistance.
- The IPM strategy of using different modes of action helps reduce that risk



https://irac-online.org/mode-of-action/classification-online/

We've relied on pesticides in the past and still rely on them today

Source:

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

What types of pesticides you may encounter at box stores & garden centers….

What are pesticides?

- Bleaches, *Lysol*, pine oil

- Weed & Feed, *Roundup*

- Rat & mouse baits

- Plant disease controls

No endorsement intended or implied

- Sevin, Pyrethroids, *Raid*

- "Organics" like pyrethrum

- Biological Controls

- Wood preservatives

No endorsement intended or implied

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to any specific product.

Source:

25B Pesticides

EPA exempt pesticides

- Some pesticides have been deregulated by EPA
  - Exempt from Federal registration
  - Must be registered by State of Maine
  - Exempt from toxicity testing
  - NOT risk free

Ingredients in some of these products:

- Rosemary oil
- Peppermint oil
- Thyme oil
- Clove oil
- Wintergreen oil
- Cinnamon oil

No endorsement intended or implied

Source:

25B Pesticides

What are the risks?

- **Peppermint oil –**
  - **oral toxicity 5 times higher than glyphosate**
  - **linked to atrial fibrillation**
  - **phytotoxic to tomatoes and radishes**
  - **allergic reactions and causes dermatitis**
  - **toxic to cats and kittens**
- **Cinnamon oil –**
  - **oral toxicity 5 times higher than glyphosate**
  - **powerful skin irritant**
  - **even worse sensitizer**
  - **cinnamon contains coumarin, which is linked to liver toxicity, liver cancer, and lung cancer in mice**

https://ecommons.cornell.edu/server/api/core/bitstreams/0a67cf6f-2c09-442f-adf1-2c60002e75f2/content
https://ecommons.cornell.edu/bitstreams/700a4eca-b375-4ee8-ba8f-989813fe0fa2/download

Warning & Toxicities:

PRECAUTIONARY STATEMENTS: This product contains wintergreen oil which may be harmful if swallowed and may irritate skin. Avoid contact with eyes & skin. This product contains plant oils that are inherently fragrant; use in well ventilated areas. Breathing vapors or mists may trigger breathing difficulty in asthmatics and others with allergies, physiological sensitivities or medical conditions. After use, vacate the treated area and allow sprays to dry before re-entering. For people who are fragrance sensitive, test a small application before using over a larger area. When used indoors, wipe up excess spray to avoid slipping.

Active Ingredients/Guaranteed Analysis:

Rosemary Oil.....1.00%
Geraniol.....0.50%
Peppermint Oil.....0.20%
Inert Ingredients*.....98.30%
Total 100.00%

*Water, White Mineral Oil, Wintergreen Oil, Polyglyceryl Oleate, Vanillin, Nitrogen

Source:

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Homemade Pesticides

What about home remedies

- Home chemistry is not recommended by the BPC
- Many of the materials used seem “safe” because we eat them or use them on our skin
- Exposure routes may be different
- What we eat may not be safe to breathe

Example

GHC GLOBAL HEALING CENTER
Natural Health & Organic Living

6. Eucalyptus oil

A great natural pesticide for flies, bees and wasps. Simply sprinkle a few drops of eucalyptus oil where the insects are found. They will all be gone before you know it

From Medline Plus – NLM NIH

http://www.nlm.nih.gov/medlineplus/druginfo/natural/700.html

- Eucalyptus oil is **POSSIBLY UNSAFE** when applied directly to the skin without first being diluted. Eucalyptus oil is **LIKELY UNSAFE** when it is taken by mouth without first being diluted. Taking 3.5 mL of undiluted oil can be fatal. Signs of eucalyptus poisoning might include stomach pain and burning, dizziness, muscle weakness, small eye pupils, feelings of suffocation, and some others. Eucalyptus oil can also cause nausea, vomiting, and diarrhea.

Children: Eucalyptus oil is **LIKELY UNSAFE** for children. It should not be taken by mouth or applied to the skin. Not much is known about the safety of using eucalyptus leaves in children. It’s best to avoid use in amounts larger than food amounts.

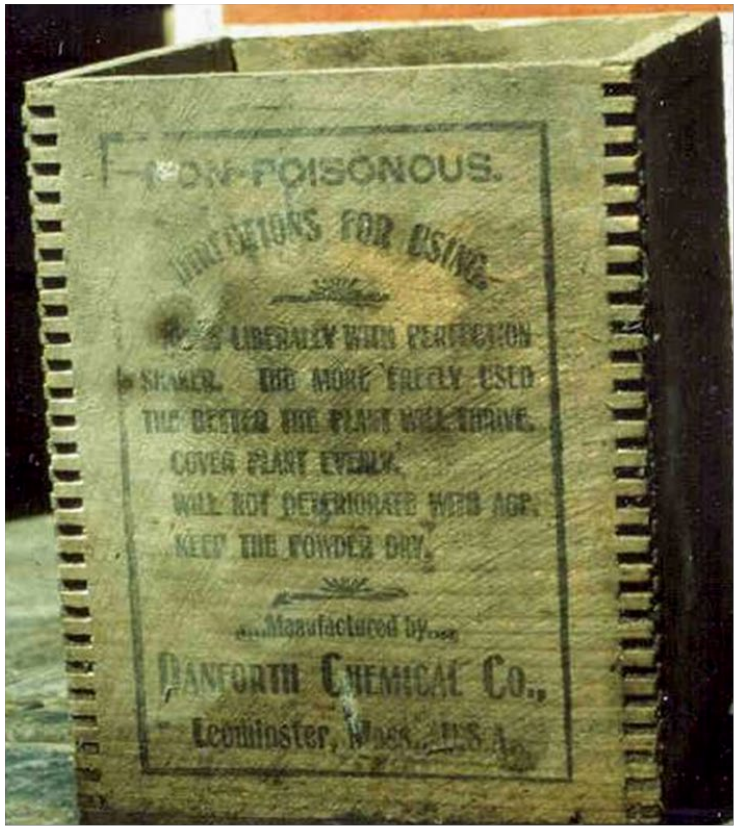
Surgery: Since eucalyptus might affect blood sugar levels, there is concern that it might make blood sugar control difficult during and after surgery. Stop using eucalyptus at least 2 weeks before a scheduled surgery.

Source:

Conventional Pesticides

The old days

Great directions!



Contained 5% lead oxide & 47% zinc oxide

"Bug Death is a patented non-poisonous powder, and is entirely different from anything that has ever been placed on the market, and overcomes all the objections to the deadly poisons that the farmers have been obliged to use in the past. It is just as effectual as Paris Green and other dangerous insect powders. It is sure death to the potato, squash and cucumber bugs, currant and tomato worms, also other plant and vine eating pests.

The deadly effect on bugs will not always be as quick, but it is just as sure. Contrary to the arsenic preparations, it is a benefit to the plant, and the more freely used the better the plant will thrive, and for potatoes when blight is prevalent, the extra yield will more than pay all expense of Bug Death."

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Conventional Pesticides

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read the entire label before using.

GENERAL INFORMATION

APPLICATION DIRECTIONS: AllDown is a fast-acting, non-selective contact herbicide for the elimination of broadleaf and grass weeds. Use on targeted weeds and grasses in flowerbeds; on targeted weeds and grasses in vegetable gardens; on targeted weeds and grasses around fruiting and non-fruiting trees, shrubs and vines; and on targeted weeds and grasses along fence lines, patios, driveways, sidewalks, and other similar areas where weed control is desired. Repeated applications may be required for larger perennial weeds or if re-growth occurs.

To prepare final spray solution, dilute one part ALLDown Concentrate with three parts water sufficient to treat at an application rate of 7.5-15 fl. oz./100 sq. ft. For larger annuals and burndown of perrenial weeds, higher application rates may be required. To achieve higher application rates, mix 1 part AllDown Concentrate with 2 parts water. Apply spray solution by ground using equipment such as hand-held, back-pack, or tractor-mounted sprayer at a rate of 7.5-15 fl. oz./100 sq. ft. when skies are mostly sunny and no rainfall is predicted within 4-6 hours of application. Use the higher rate when weeds are dense or the foliage is heavy. Do not apply more frequently than every two weeks. Rain just after application will reduce product effectiveness. Apply when the air is calm and temperatures are 65-90° F. Best results are achieved from spring to early summer when young weeds are growing more actively, and on small weeds less than 3-5 inches high. Only contacted vegetation will be affected. For spot treating, apply to target vegetation in sufficient volume to thoroughly wet the leaves.

For control of larger annuals and burndown of perennial weed growth. Larger annual weeds and perennials are more difficult to control and may require re-treatment. Treat initially as directed above and repeat if new growth of leaves appears. Thorough coverage of all foliage is necessary to achieve desirable control.

Do not apply to desirable plants. Severe injury will occur to non-target plants if AllDown contacts the foliage of these plants.
Do not apply to reactive metals such as aluminum, tin, iron, or items such as fencing or lawn furniture. If the product contacts these surfaces, staining, mottling, or other harm to the finishes or surfaces may occur.
Do not use spray equipment with metal working parts such as metal spray lines or metal nozzles.
Do not apply more frequently than every two weeks.

OMRI Listed

WEEDS CONTROLLED
ANNUAL BROADLEAF WEEDS such as: Chickweed, black medic, cinquefoil, lambsquarter, mustard species, oxalis, pigweed, ragweed species, shepherd's purse, stinkweed, portulaca, round-leaf mallow
PERENNIAL WEEDS such as: Canada thistle, cinquefoil (silvery), common burdock, dandelion, ground ivy (creeping Charlie), plantain, spotted spurge, toadflax, tufted vetch, wild carrot
ANNUAL GRASSES such as: Foxtail species, crabgrass, barnyardgrass, seedling Johnsongrass
PERENNIAL GRASSES such as: Quackgrass, common bermudagrass, ryegrass

Summerset Products
130 Columbia Court
Chaska, MN 55318
www.summersetproducts.com

EPA Reg. No.: 84069-1
EPA Est. No.: 063416-MN-001
Batch Code:

8 58493 26625 6

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Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Conventional Pesticides

FIRST AID	
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.

NOTE TO PHYSICIAN
Probable mucosal damage may contraindicate the use of gastric lavage.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. **For emergency information, call 1-800-222-1222** (24 hours per day, 7 days per week) for a local poison control center.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER. Corrosive: Causes irreversible eye damage. Do not get in eyes or on clothing. Wear protective eyewear such as goggles, face shield, or safety glasses. Harmful if swallowed, absorbed through the skin, or inhaled. Avoid breathing spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS
For terrestrial use only. Do not apply directly to water. Do not contaminate water when disposing of equipment washwaters or rinsate. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run off to water bodies or drainage systems.

STORAGE AND DISPOSAL
Do not contaminate water, food or feed by storage or disposal.
Pesticide Storage: Store in a dry, cool place.
Pesticide Disposal: To avoid wastes, use all material in this container by application according to label directions. If wastes cannot be avoided, offer remaining product to a waste disposal facility or pesticide disposal program (often such programs are run by state or local governments or by industry).
Container Disposal (quart, 1 gallon, or 2.5 gallons): Nonrefillable container. Do not reuse or refill this container. **Do not use bleach to rinse container.** Triple rinse (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into the application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling, if available, or puncture or dispose of in a sanitary landfill, or by incineration. Do not burn unless allowed by state and local ordinances.

WARRANTY STATEMENT
SummerSet Products (SummerSet) warrants that this Product conforms to the specifications on this label. To the extent consistent with applicable law, SummerSet makes no other warranties and disclaims all other warranties, express or implied, including but not limited to warranties of merchantability and fitness for a particular purpose. No agent of SummerSet or any other person is authorized to make any representation or warranty beyond those contained herein.

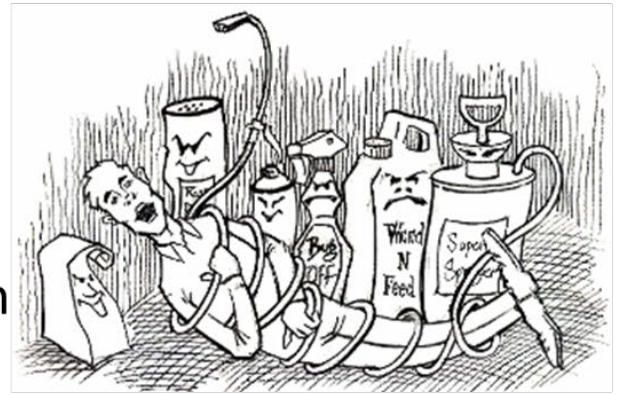
It is impossible to eliminate all risks associated with this Product. Lack of performance or other unintended consequences may result because of factors such as use of the Product other than in strict accordance with this label's instructions, presence of other materials, the manner of application or other factors, all of which are beyond the control of SummerSet or the seller. To the extent consistent with applicable law, all such risks shall be assumed by the Buyer.

To the extent consistent with applicable law, SummerSet disclaims any liability whatsoever for special, incidental or consequential damages resulting from the handling or use of this Product and SummerSet's liability under this label shall be limited to the amount of the purchase price or, at the election of SummerSet, the free replacement of the Product.

Conventional Pesticides

Purchase wisely

- Measure the area needing treatment
- Only purchase what you need “right now”
- Check the label for:
  - re-entry
  - site & pest
  - days to harvest
  - personal protective equipm



Conventional Pesticides

Prepare for the application

- Read the label
- Wear all PPE
- Mix carefully
- More is NOT better
- Never use more than the label directs

Source:

Conventional Pesticides

Apply properly & be cautious

- Only treat infested areas
- Spot treatments conserve beneficial organisms
- Avoid broadcast treatments
- Keep the plant's condition in mind
- Check coverage & monitor control
- Only repeat application if the label allows

Source:

Conventional Pesticides

Broadcast applications

- Broadcast applications of lawn herbicides can cause weird results

- Broadcast applications of any pesticide are prohibited within 25 feet of any wetland or water body

Source:

Questions & Additional Resource Links