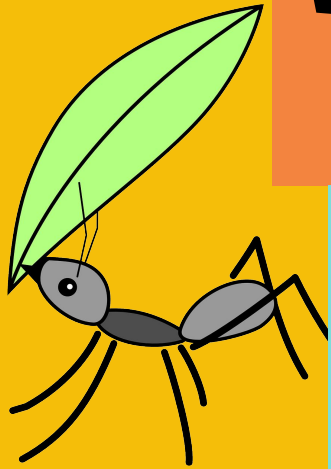


**What's bugging your garden**



*And what to do about it*

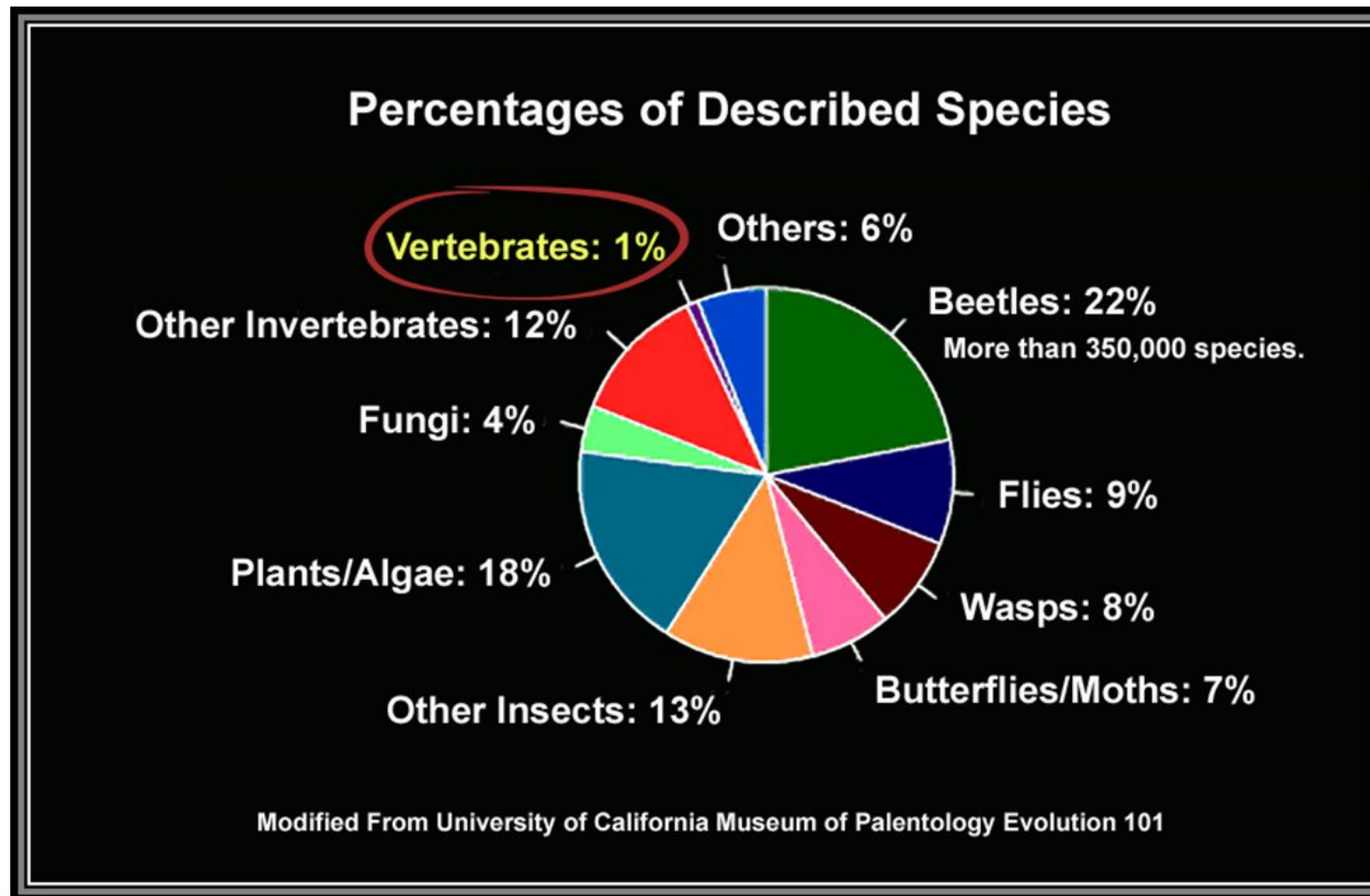
# What's on tap for today

- ❑ Insects—fact of life, know thine enemy—immature bugs [\*usually] look different than their parents!
- ❑ Plant damage—the mouth makes the difference
- ❑ Frequent bad bugs in your garden
- ❑ Let's try HORTSENSE!
- ❑ What to do about them! Integrated Pest Management

# We're outnumbered!

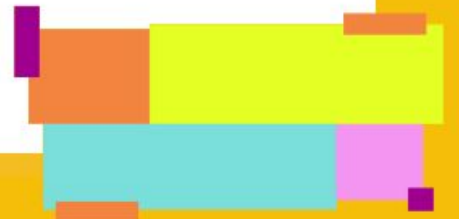
- About 1 million known insects
- 1000 are serious pests
- 10,000 are occasional pests

The remaining 97% are neutral or beneficial!



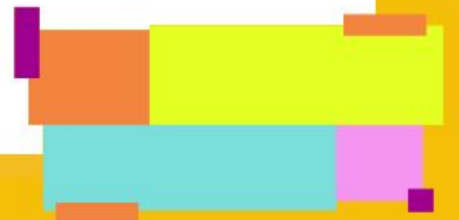
# **Sure things: Death, taxes, and garden insects!**

- Even if you do everything right, it's unrealistic to expect your garden to be pest free!
- Keeping your garden healthy is the best way to reduce the impact of our buggy visitors



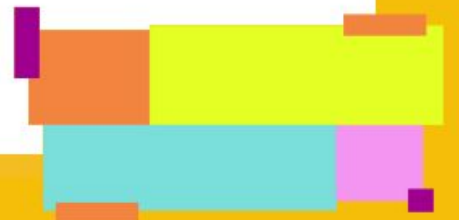
# But where do they come from?

- Healthy plants give off scents that insects can detect from far away
- Stressed plants emit chemicals that let the world of bugs know that they are vulnerable.
- They can be brought in with other plants
- They can be hiding in the soil or other plants until it's time to come out and eat.



# What's the best defense against insect pests?

- Know your enemies
- Learn to identify the insects
- Get to know what they look like in **all their life stages.**
- BE VIGILANT! Check your plants every day to catch small glitches before they become big problems!

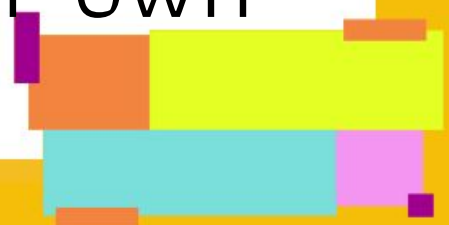


# Insects can look drastically different during their life stages

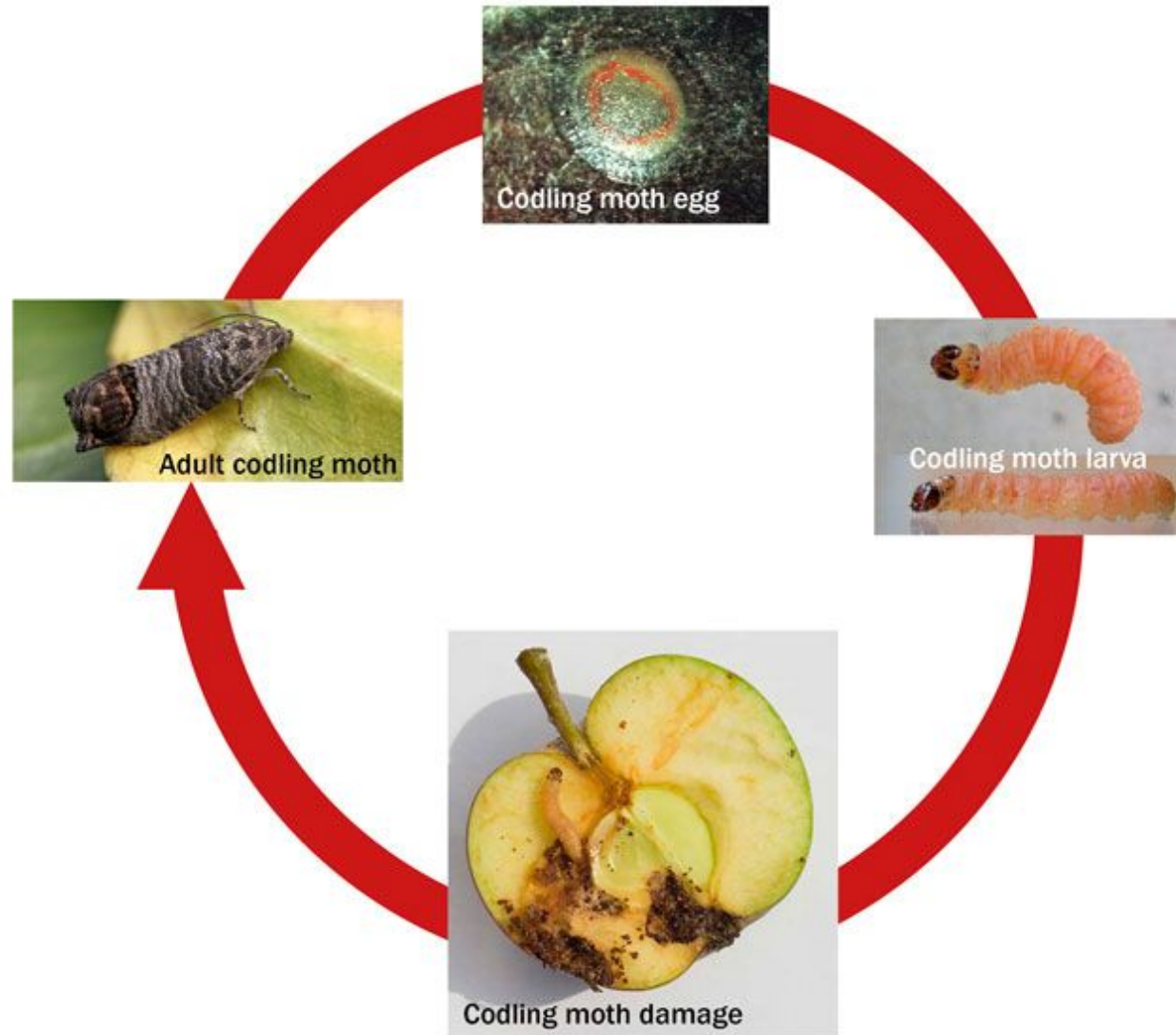
- Example –caterpillar turns into a butterfly or moth.

## **But wait—There's more!**

- Egg, larva, pupa, adult—they can look different during each of these states.
- This makes identification difficult on your own



# You can have all life stages in your garden at the same time!



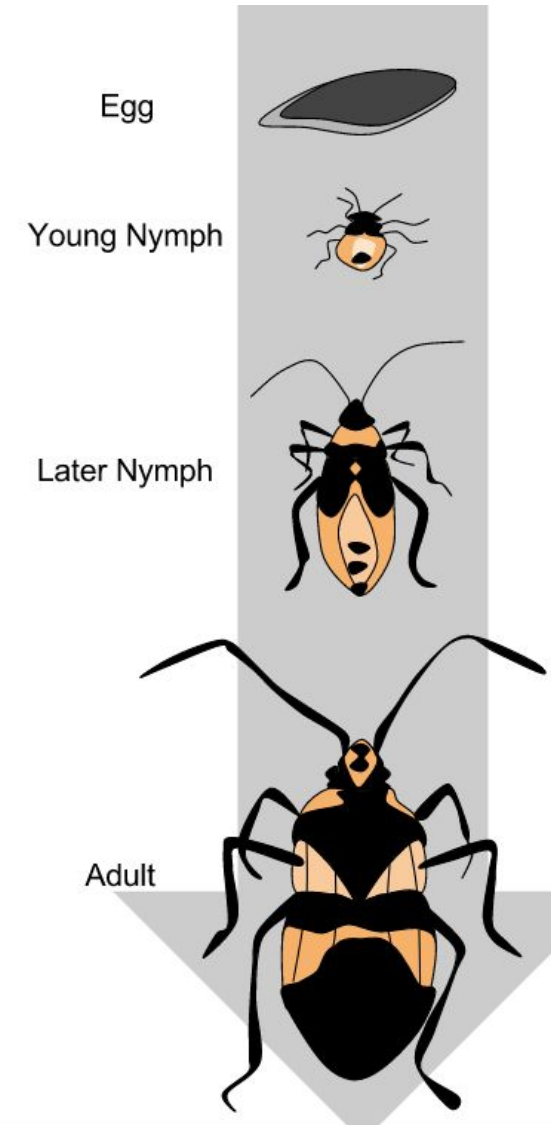
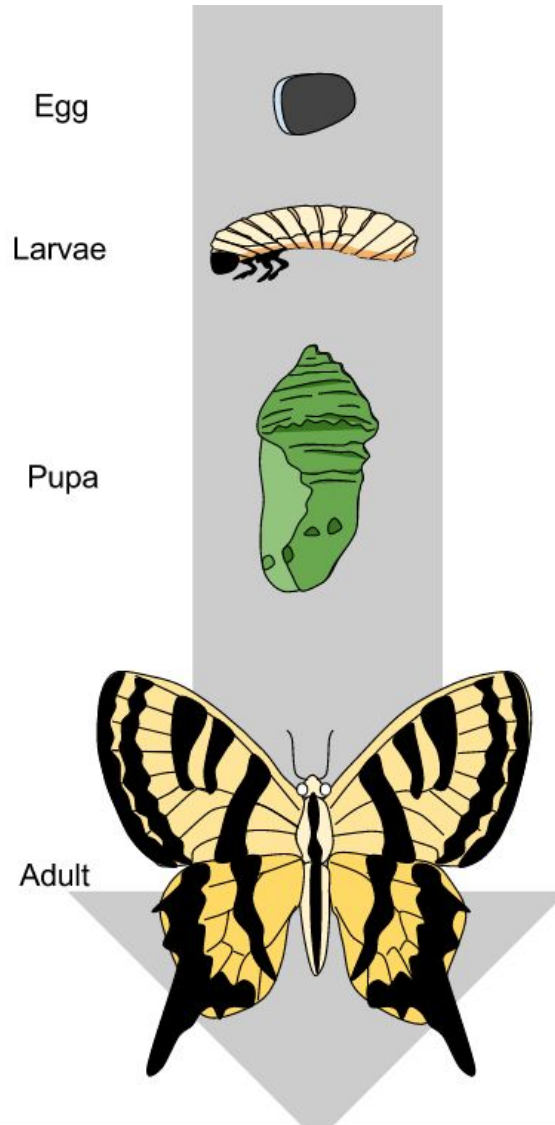
Codling Moth

<https://smartergreenbio.com.au/wp-content/uploads/2019/03/Codling-moth-life-cycle.jpg>



# Metamorphosis

- Greek – “change form”
  - Complete
    - egg – larva – pupa – adult stages
  - Incomplete
    - egg – nymph – adult stages



# Complete

- egg
- larva
- pupa
- adult



**the  
dodo**



# Incomplete (egg – nymph – adult stages)

**Brown Marmorated Stinkbug**  
*Halyomorpha halys* – Pentatomidae  
aka **BMSB**



eggs & 1<sup>st</sup> Instar

Black & White Banding

Adult

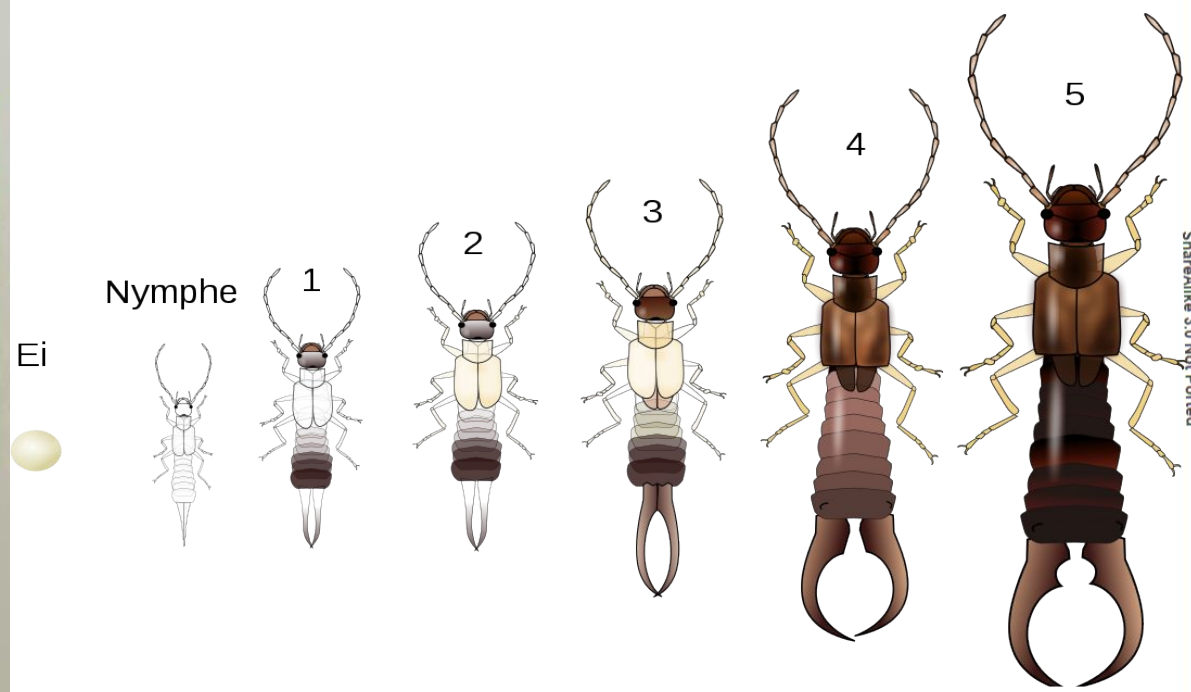
4<sup>th</sup> Instar

Rutgers University

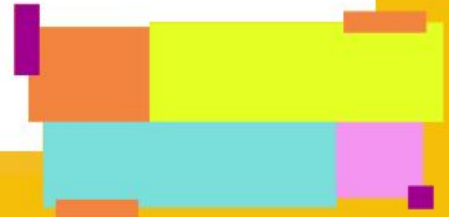
David Lance -USDA

UGA1460052

W St

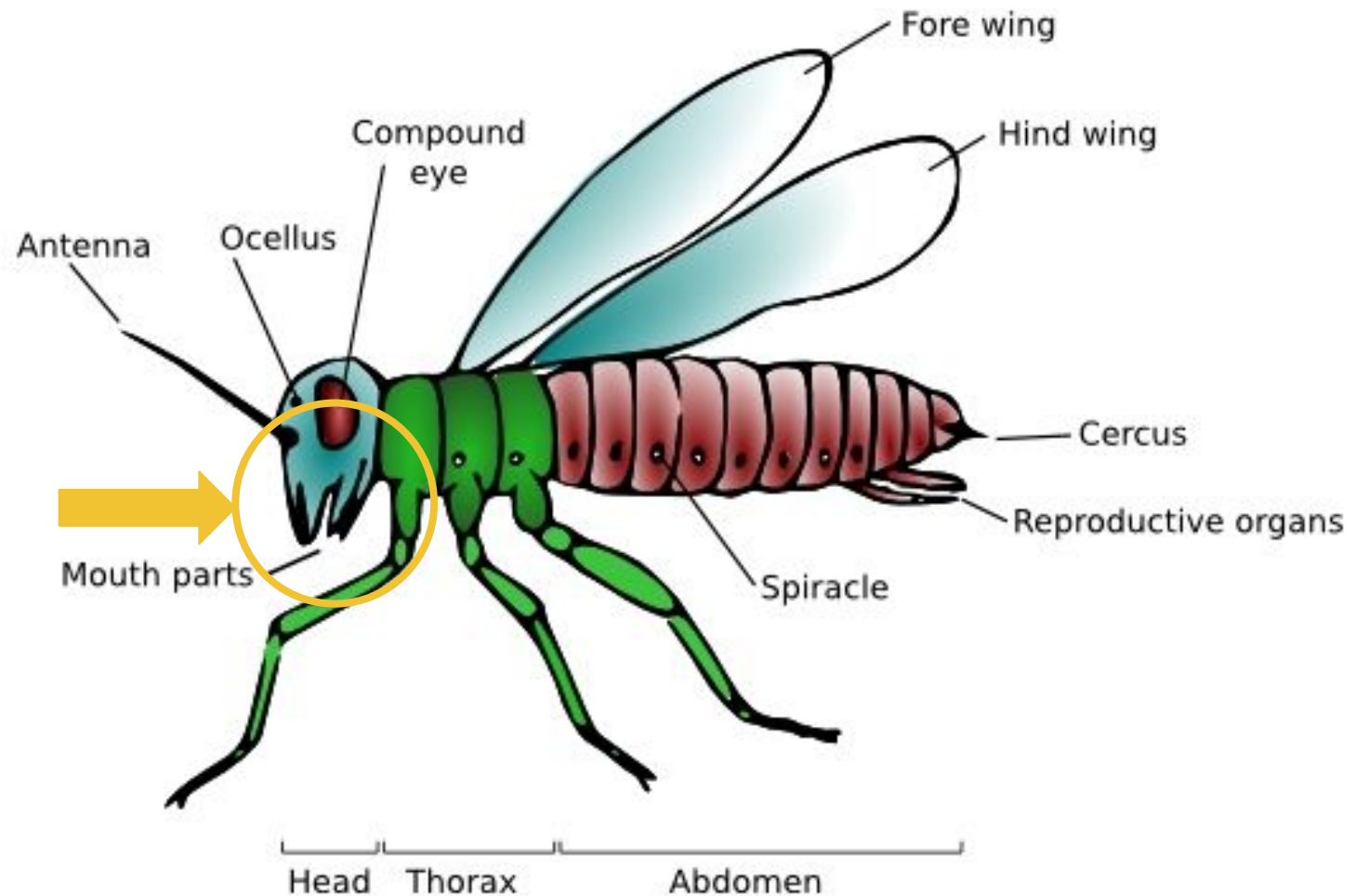


Erwig\_life\_cycle\_upwards.svg : Bugboy6240 Creative Commons license "Attribution-ShareAlike 3.0 Not Ported"



# Insect Anatomy

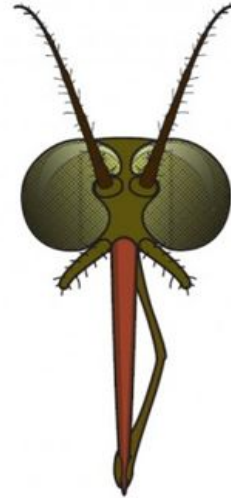
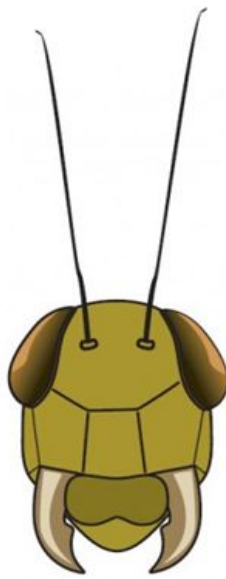
1. Body divided into THREE parts
2. 3 pair of legs [SIX total] attached to thorax
3. Most adults have TWO pair of wings
4. Exoskeleton
5. TWO Antennae



# The Head & Mouth Parts

- Characteristic plant damage by each type—like a “footprint”
- Most **plant damage** caused by:
  - Chewing
  - Piercing-sucking

## Insect Mouthpieces



CHEWING	PIERCING-SUCKING
Beetles	"Shield" bugs
Grasshoppers	Aphids
*Moths	Leafhoppers
*Butterflies	Whiteflies
*Flies	Thrips
*Sawfly	Spider mites
*Larvae have chewing mouthparts	Azalea Lace Bugs
	Scale

Siphoning

Sponging

Lepidoptera

Diptera

# Damage caused by **chewing** mouthparts

- Chewing insects eat plant tissue
  - Holes in leaves
  - Notching along edges of leaves
  - Skeletonized leaves



[https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/8605/files/2019/05/4-Imported-Cabbageworm-damage-on-cabbage\\_Whitney-Cranshaw-COLORADO-STATE-UNIVERSITY-Bugwood.org\\_-1.jpg](https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/8605/files/2019/05/4-Imported-Cabbageworm-damage-on-cabbage_Whitney-Cranshaw-COLORADO-STATE-UNIVERSITY-Bugwood.org_-1.jpg)  
5443232



Figure 4: Traminette leaves skeletonized by Japanese Beetle. Photo by: Andy Muza



# Damage caused by **piercing sucking** mouthparts

- Pierce leaf tissue, withdraw fluids,
  - Discolor [yellowed, silvery, bronzy coloration]
  - Distort leaf tissue [twisted, curling]



Photo 3. Twospotted spider mite injury on soybean. Photo by Whitney Cranshaw, [www.ipmimages.org](http://www.ipmimages.org)

# Chewers



Imported  
cabbage worm



Cabbage looper



# Chewer: Flea Beetle



Whitney Cranshaw, Colorado State University, Bugwood.org  
Creative Commons License licensed under a Creative  
Commons Attribution 3.0 License.



Flea Beetles



# Chewer: Western Spotted Cucumber Beetle



Western spotted cucumber beetle



© Ken Gray Insect Image Collection



Western Spotted  
Cucumber Beetle

# Cutworms (nocturnal) Loopers(day time)



Caption: Variegated cutworm larvae  
Photo by: A.L. Antonelli



Caption: Celery looper pupa  
Photo by: A.L. Antonelli



Caption: Looper on rhododendron  
Photo by: S. J. Colman



Beet armyworm  
*Spodoptera exigua* Hubner  
Immature female adult  
© Ken Gray Insect Image Collection

Damage is frequently seen in seedling vegetables and flowers as plants cut off at or just below the soil line. There are also climbing cutworms which chew leaves. [Cutworms and Loopers](#)

# Army worms—lawn destroyers this spring



Lambsquarters

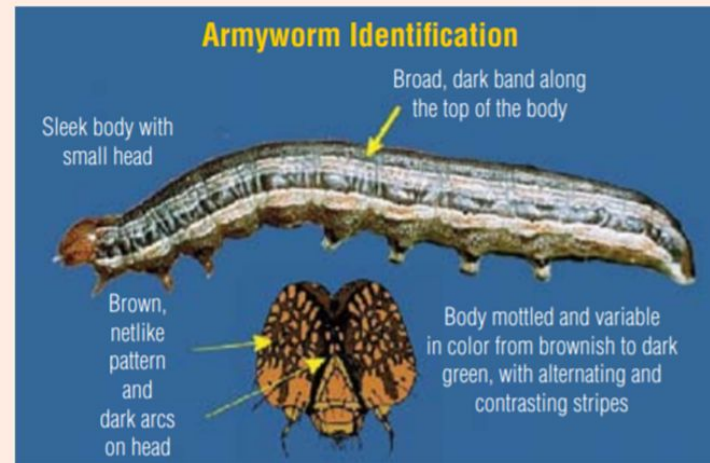


Figure 4. Identifying armyworm larvae.



Figure 5. Red, torpedo-shaped pupa of the armyworm.



# Chewer—Apple Maggot



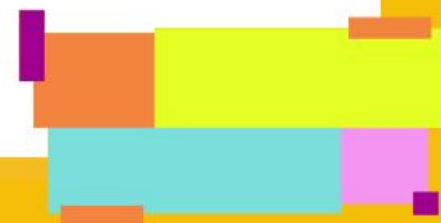
[Apple Maggot](#)



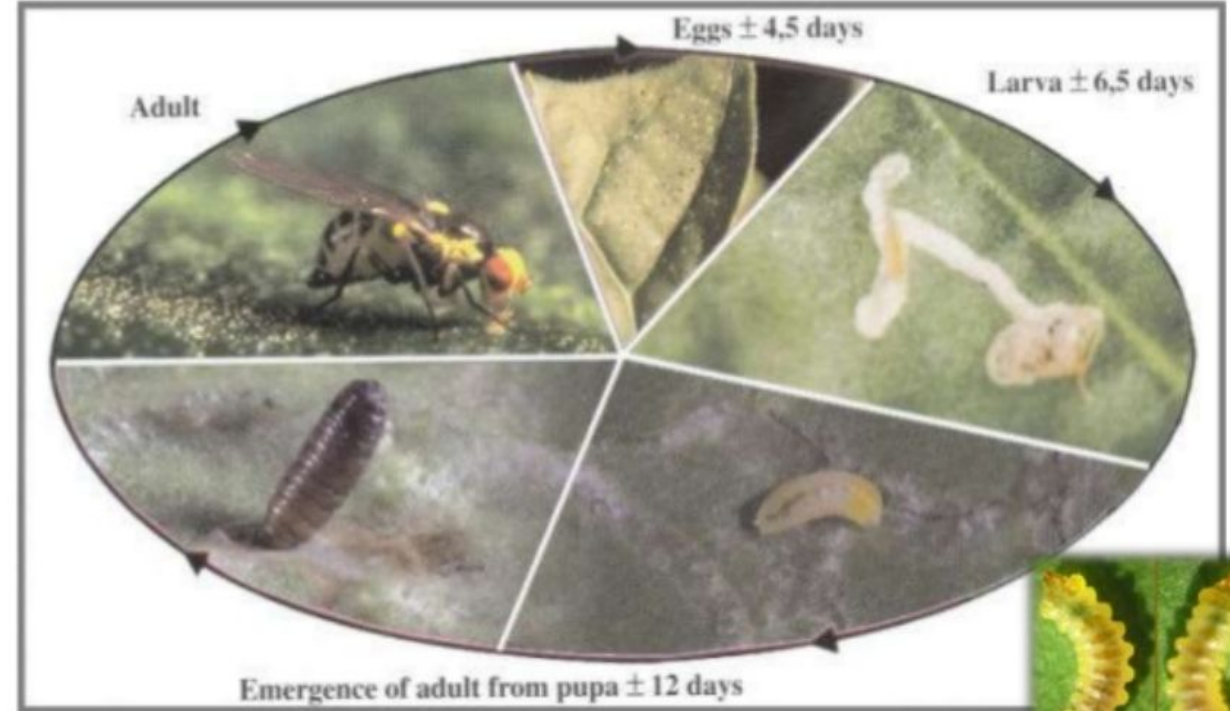
# Codling Moth



[Codling Moth](#)



# Invisible chewers: Leaf Miners—beets, spinach, chard



- Control weeds
- Rotate crops
- Pinch leaves
- Pick out infested leaves
- Screen plants with a floating row cover [April-May].
- Do not put row covers over soil previously infested with this pest.



[Spinach and beet miners](#)

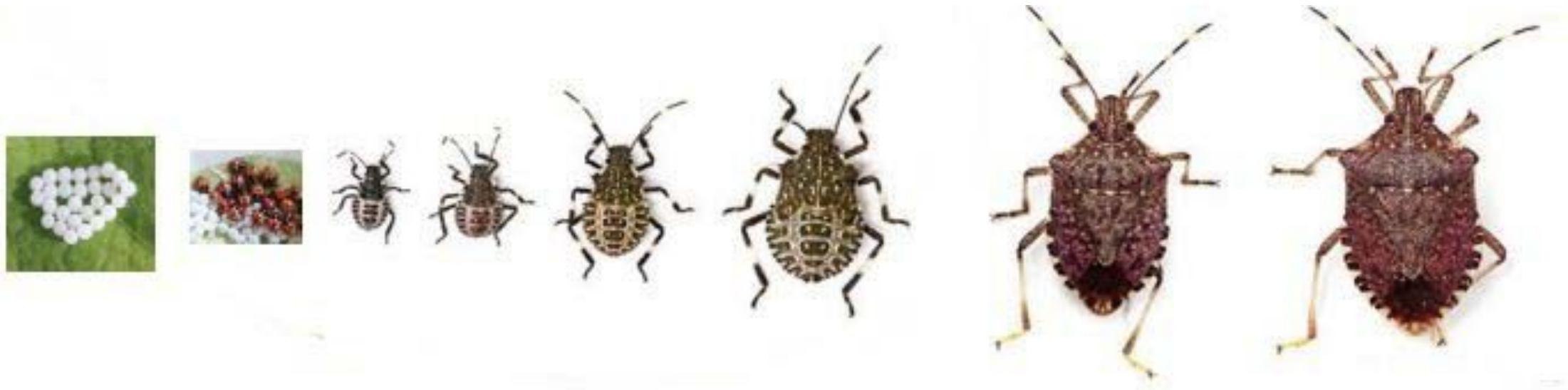
# Piercing sucking: Brown marmorated stink bug



“Shield bug” damage to tomatoes and apples—[Brown Marmorated Stink Bug](#)



# Recognize immature stink bugs



Allentown, Pennsylvania 1996\*Vancouver, WA 2010\*Kalama, WA 2014  
and the rest is history!

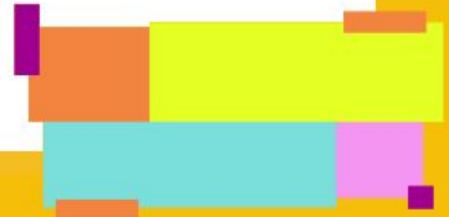
<https://extension.umn.edu/nuisance-insects/brown-marmorated-stink-bug> Photo W. Hershberger



# Plant damage by piercing sucking mouthparts



*Aphids and whiteflies sucking the juices from new growth causing stunted growth, leaf yellowing*



# Suckers: Aphids

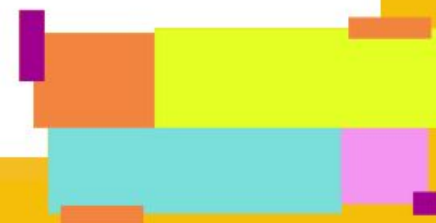


UC Statewide IPM Program  
© 2007 Regents, University of California

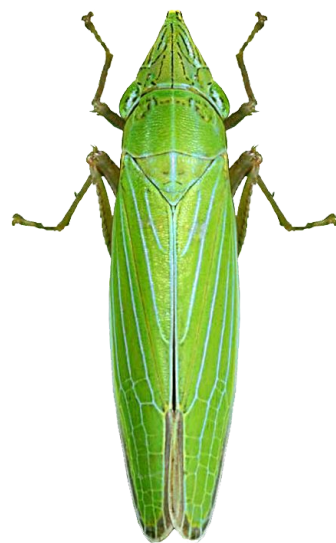


Wingless adults and nymphs of the potato aphid.

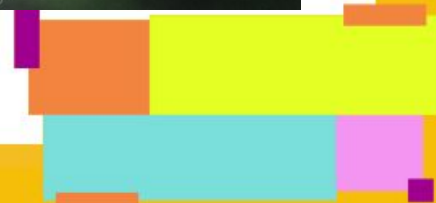
[Aphids](#)



# Plant damage by piercing sucking mouthparts



Leafhoppers—Lighter colored areas on leaf where plant tissue has been extracted



# Plant damage by piercing sucking mouthparts



Thrips- distorted leaves, bronzy appearance from leaf feeding



Spider mites—webs and silvery/white appearance from leaf feeding



5369738

Two-spotted spider mite

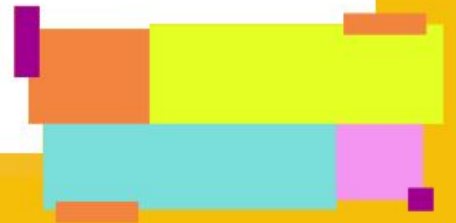
# Nuisance insects



Spittlebug

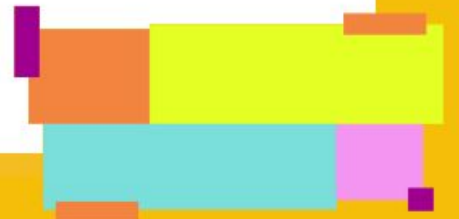


Boxelder Bugs



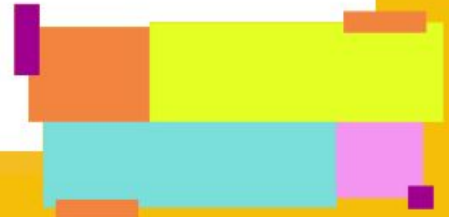
# Integrated Pest Management (IPM)- Best way to protect your garden

- Use a variety of common-sense methods to control problems in the garden, not just using pesticides!
- Monitoring the pest's activity and adjusting methods over time
- **Tolerating harmless pests**
- **Setting a threshold to decide when it's time to act**



# Ways to protect your garden

- Have a healthy garden
  - Good airflow, fertilize, and water properly
  - Keep a very close watch for problems
- Control access to your plants
  - Row cover
  - Crop rotation
  - Mulch
  - Weed control
- Repellant-
  - diatomaceous earth [crawling insects]
  - Pheromone lures [insect specific]



# Ways to protect your garden—After visually identifying insect pest

## Use the least toxic methods first

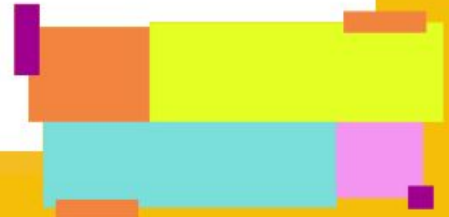
- Best control: Your thumb and index finger, despite the “YUK factor”!
- Strong spray of water
- Biological controls
- Pesticides—least toxic [spot treat!! The affected plant and shield others]





# **Last resort**—pesticide. **READ THE LABEL!**

- Again—**ID the insect--contact the Plant and Insect Clinic!**
- Find the product that solves the problem. The **insect will be listed on the label** if it's effective for that problem
- Buy the right amount—label tells how much you'll need, and some won't remain effective if stored.
- **FOLLOW DIRECTIONS- when** and **how** to apply, how long before picking fruits/veggies.
- **More is not better**—you can harm plants, lawn, water supply!
- Dispose properly



# WSU's list of common offenders

[Asparagus](#) [\\*Guide](#)

[Lettuce](#)

[Bean](#)

[Onions, Garlic](#)

[Beet, Chard](#)

[Pea](#)

[Broccoli, Cole crops](#)

[Pepper, Eggplant](#)

[Cantaloupe, Melons](#)

[Potato](#)

[Carrot](#)

[Radish](#) [\\*Problem solving](#)

[Corn](#)

[Spinach](#)

[Cucumber, Pumpkin,  
Squash](#)

[Tomato](#)

[Turnip, Rutabaga](#)

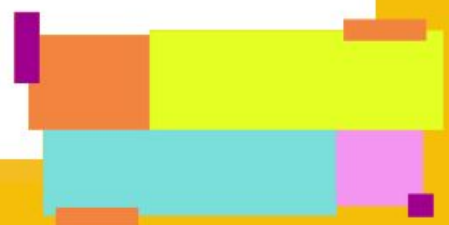
**[Hortsense](#)** - <http://hortsense.cahnrs.wsu.edu>

•Search by crop:

<http://hortsense.cahnrs.wsu.edu/Search/MainMenuWithFactSheet.aspx?CategoryId=5>

**[Pestsense](#)**

**Always choose the  
LEAST TOXIC OPTIONS!**  
[SIMPLE, HOLISTIC, COMMON  
SENSE METHOD OF  
MANGING GARDEN PESTS &  
DISEASES](#)



## Cheat Sheet: Least Toxic Pesticides

### Organic-

### Least to most toxic to beneficials

- **Bt** -caterpillars--little or no toxicity to any other organism
- **Diatomaceous Earth**
- **Neem oil** - azadirachtin
- **Insecticidal Soap** - Potassium salts of fatty acids
- **Spinosad** - E.g., Entrust, Success, Regard, Bonide Captain Jack's Deadbug Brew R-T-U; apply at night
- **Boric Acid** - ants
- **Pyrethrin** - highly toxic--apply at night

## Cheat Sheet: Synthetic Pesticides

- **ALL highly toxic to bees**

- **Acetamiprid**
- **Acephate**
- **Bifenthrin**
- **Carbaryl**  
(E.g., Sevin)
- **Cyfluthrin**
- **Esfenvalerate**
- **Cyhalothrins**
- **Malathion**
- **Permethrin**

### READ THE LABELS

- **How to use**
- **Target use and insects**
- **How to dispose**
- **Protect yourself, the environment, and pollinators**



Products containing Spinosad



Products containing Bacillus thuringiensis



Products containing Azadirachtin



Insecticidal Soaps



# TAKE HOME--Best offense is a good defense!

- Be proactive--visit your garden every day
- Keep your garden healthy--irrigation, airflow, fertilizing, removing damaged leaves
- THERE WILL BE BUGS--if they're not causing much damage, leave them alone or pick them off the plant. Remember that beneficial bugs need something to eat, too!
- If you need to act, be sure of the culprit, start with the least toxic methods following all directions. SPOT TREAT to minimize killing beneficial insects
- Continue to monitor after treatment.
- Rinse and repeat!

# For future reference (snap a photo of this with your phone)

You can review this presentation at  
[cowlitzcomg.com/lookingahead](http://cowlitzcomg.com/lookingahead)

You can also see our **monthly garden guides** on that webpage.


Contact the WSU Plant and Insect Clinic for  
any gardening questions, including insect ID

and help: [cowlitzcomg.com/plant-and-insect-clinic](http://cowlitzcomg.com/plant-and-insect-clinic) or  
[cowlitzmastergardener@gmail.com](mailto:cowlitzmastergardener@gmail.com), or 360-577-3014 ext. 8

# Resources

 WSU Hortsense <http://hortsense.cahnrs.wsu.edu/>

 [SIMPLE, HOLISTIC, COMMON SENSE METHOD OF MANGING GARDEN PESTS & DISEASES](#)


 Pest Control in Home Vegetable Gardens EM009E  
<http://pubs.cahnrs.wsu.edu/publications/wp-content/uploads/sites/2/publications/em009e.pdf>

WSU Pestsense <http://pestsense.cahnrs.wsu.edu/Home/PestsenseHome.aspx>

Clemson University: Less Toxic Insecticides:  
<https://hgic.clemson.edu/factsheet/less-toxic-insecticides/>

Toxicity of Pesticides to Pollinators and Beneficials  
<https://ag.umass.edu/fruit/ne-small-fruit-management-guide/appendices-resource-material-listings-conversion-tables-0>


Pesticides: Safe Handling  
<https://s3.wp.wsu.edu/uploads/sites/2071/2014/04/Pesticides-Safe-Handling-FSIPM002E.pdf>

 These are the basic information sources that will get you through the growing season

WSU Pest Leaflet Series <https://puyallup.wsu.edu/plantclinic/pls/>

Pest Management Guide for Apples in Washington Home Orchards  
"WSU EM101E" <http://pubs.cahnrs.wsu.edu/publications/pubs/em101e/>

Organic Pest and Disease Management in Home Fruit Trees and Berry Bushes "WSU EM066E" <http://pubs.cahnrs.wsu.edu/publications/pubs/em066e/>


 Encouraging Beneficial Insects in Your Garden  
<https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw550.pdf>

Beneficial Insects, Spiders, and Mites in Your Garden: Who they are and how to get them to stay "WSU EM067E"  
<http://pubs.cahnrs.wsu.edu/publications/pubs/em067e/>

The **precautionary statements**

describe potential harmful effects to people, animals or the environment.

The **directions for use** tell you where, when and how to use the pesticide safely. Follow these directions precisely. This section also tells you what kind of pest this product was designed to kill.

<p><b>PRECAUTIONS TOXIC TO</b></p> <p>Mauris ante sem, aliquet in, tristique ut, rhoncus nec, ligula. Donec ut nibh. Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempor, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec</p>	<p><b>RESTRICTED USE PESTICIDE</b></p>	<p><b>KEEP OUT OF REACH OF CHILDREN</b></p>
<p><b>DIRECTIONS FOR USE</b></p> <p>Ut, rhoncus nec, ligula. Donec ut nibh. Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempor, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec</p>	<p><b>PRODUCT NAME<sup>®</sup></b></p> <p>COMMON NAME</p> <p>CHEMICAL NAME</p> <p>ACTIVE INGREDIENT _____%</p> <p>INERT INGREDIENTS _____%</p>	<p><b>CAUTION</b></p> <p>ulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempor, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec</p>
<p><b>RE-ENTRY STATEMENT</b></p> <p>Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis e</p> <p><b>CATEGORY OF APPLICATOR</b></p>	<p><b>DANGER-POISON</b></p>  <p>STATEMENT OF TREATMENT</p>	

The **Restricted Use Pesticide** tells you only certified pest management professionals may use this product.

The **product or brand name** is prominently displayed on the front label. Brand names are different from active ingredients.



The **storage and disposal** instructions tell you how to store and dispose of leftover pesticides.

The **Environmental Protection Agency Registration number** ensures that the pesticide has been reviewed by EPA.

## STORAGE & DISPOSAL

Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempus, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec

## STATEMENT OF TREATMENT

IF SWALLOWED.....  
IF INHALED.....  
IF ON SKIN.....  
IF ON EYES.....

MFG. BY \_\_\_\_\_  
CITY, STATE \_\_\_\_\_  
ESTABLISHMENT NO. \_\_\_\_\_  
REGISTRATION NO. \_\_\_\_\_  
NET CONTENTS \_\_\_\_\_

## HAZARD TO

Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempus, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec

## WARRANTY STATEMENT

Nulla urna. Maecenas non odio vitae lorem molestie cursus. Sed lobortis erat lobortis ante. Pellentesque tempus, metus at ullamcorper egestas, nibh odio porta libero, blandit varius elit erat vel mauris. Donec

The **active ingredient** is the chemical that kills the pest.

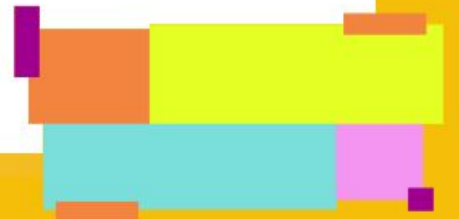
**Inert or other ingredients** do not directly kill the pests, but instead help the active ingredients work. They may be harmful.

The **first aid section** tells you what to do if the product is swallowed, breathed in (inhaled), or has made contact with the skin or eyes.

The **signal words** such as **Caution, Warning, Danger, or Danger-Poison** refer to the short-term or acute effects of the active ingredient.

# Research tip:

- There is LOT of misinformation out there
- Turn to trusted sites that base their information on research
- Example—Universities, government, some organizations
- Start your search with “edu” or “gov” or “org” to get reliable information
- WSU has a GREAT gardening research: Hortsense!



**Please mute your phones to eliminate background noise.**

To ask a question, hold down the space key (like a walkie-talkie) to unmute while you speak.

