

Introduction to Biotic Pests and How to Diagnose Them

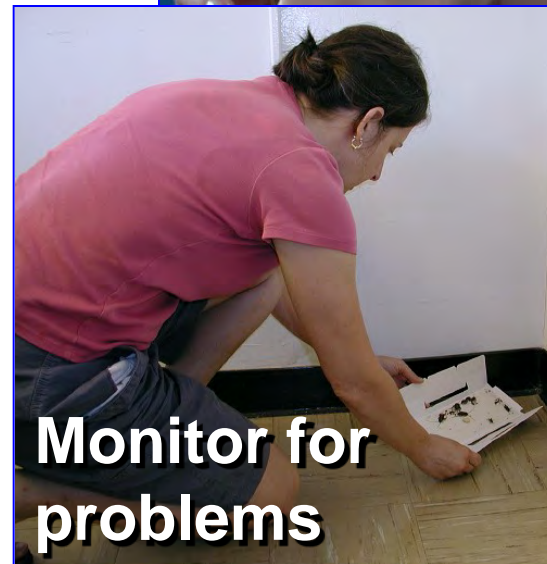
- Types of pests
- Importance of pest identification
- Information resources



Project
University of California

What is the idea behind IPM?

- **Ecologically-based approach**
- **Prevents problems**
- **Based on knowledge of pest, biology, and habitat**
- **Don't spray just because you see a pest**
- **Uses least-toxic methods to protect people and environment**



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UC IPM

Statewide Integrated Pest Management Program

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- Highlights: [2014 Annual Report](#)
- New: [Seasonal Landscape IPM Checklist](#)
- Ag Pest Management: [Rice, Cherry, Almonds, Peach, Nectarine, Citrus and Alfalfa updated, Grape and Pistachio revised](#)
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Home, Garden, Turf & Landscape Pests



Agricultural Pests



Natural Environment Pests



Exotic & Invasive Pests



IPM tools and techniques

- Combine practices for long-term management



- ✓ Prevention
- ✓ Cultural practices
- ✓ Physical/mechanical
- ✓ Biological control
- ✓ Pesticides, if needed
 - Monitor to detect and assess problems
 - Use least-toxic materials

Identify your pest

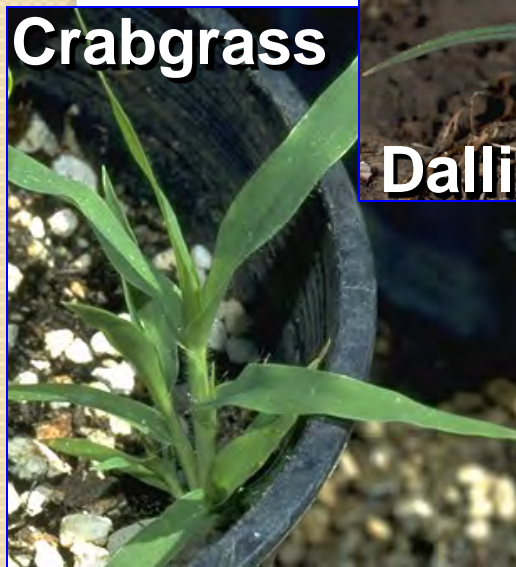
- Identify your pest
- Understand its life cycle



**Damage to lawn
from improper
watering**



Crabgrass



Dallisgrass



Lady beetle larva



Beneficial insects

**Syrphid
fly larva**



Types of Pests



Insects/mites



Pathogens



Weeds



Molluscs



Nematodes



Vertebrates

Insects and Mites

Insects

Head, thorax, and abdomen
3 pairs of legs

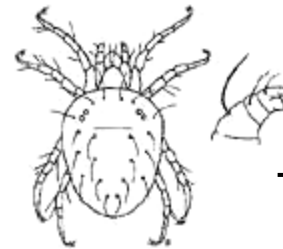


Mouthparts

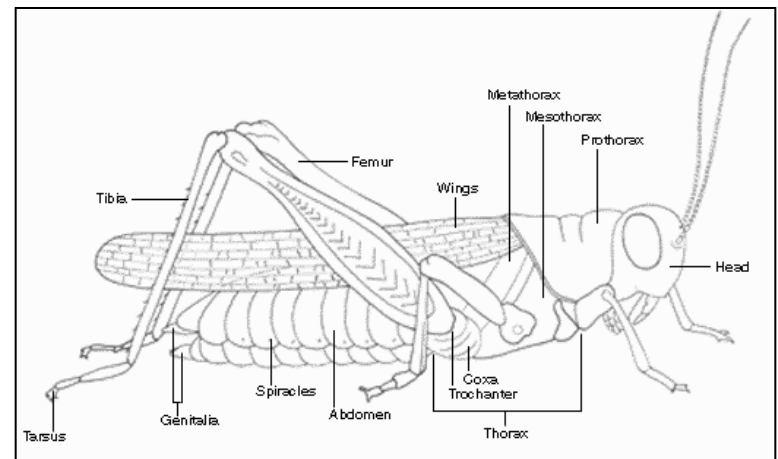
- **chewing** (beetles, caterpillars)
- **piercing-sucking** (aphids, bugs)
- **sponging** (flies)
- **siphoning** (moths)
- **rasping-sucking** (thrips)
- **cutting-sponging** (biting flies)
- **chewing-lapping** (wasps)

Mites

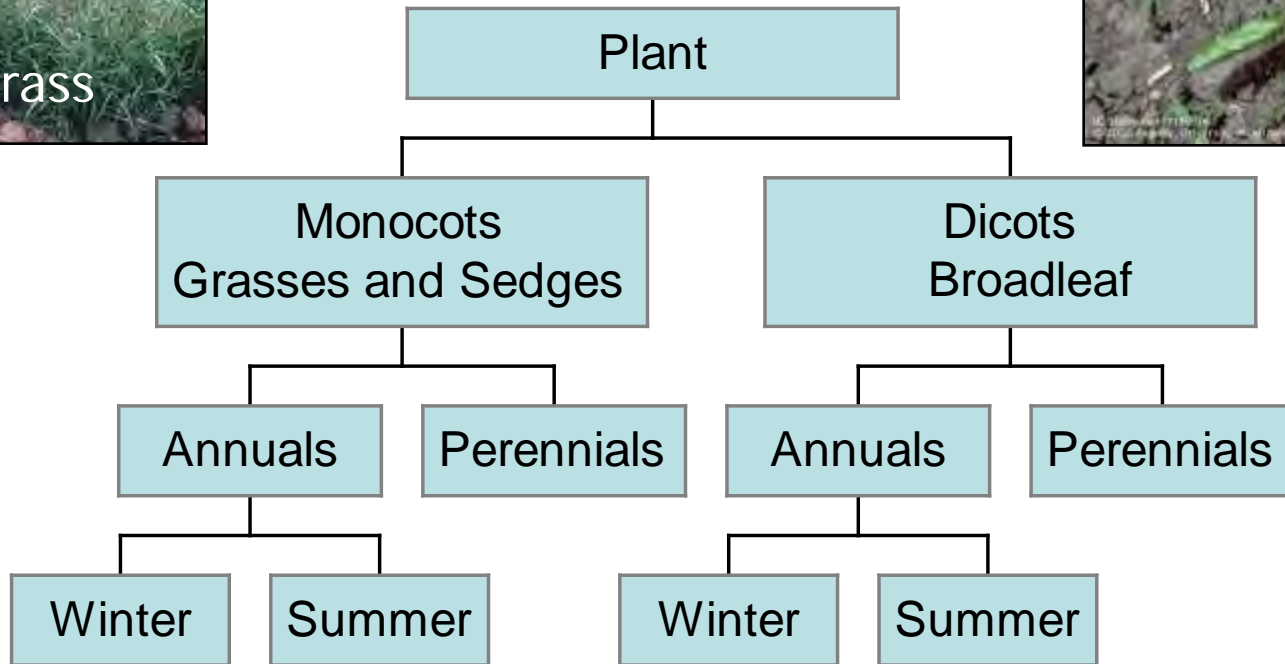
Two body parts
4 pairs of legs



piercing-sucking



Weed Classifications



Annual bluegrass



Crabgrass



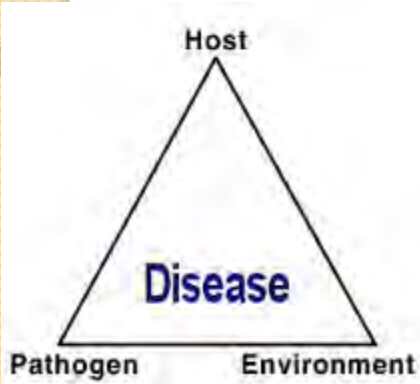
Mallow



Spotted spurge

Pathogens and Nematodes

- Virus
- Bacteria
- Water molds



Old model



Almond Alternaria
Leaf Spot



Verticillium Wilt



Female root-knot
nematode next to root gall



Adult root lesion nematodes
inside root

time
↑
↓



New model

Vertebrates



Ground squirrels



Birds



Rabbits



Gophers



Voles

Snails and Slugs



Adult brown garden snail



"Hibernate" in hot weather



Gray garden slug

Importance of Pest Identification

- Have to identify the problem before it can be solved.
- Requires correlating pests to damage.
 - Damage from insects, diseases, weeds, etc., vs.
 - Damage from equipment, nutrition, water mat., etc.



Big-eyed bug—
beneficial insect

False chinch bug—
sporadic, minor pest

Lygus bug—major
pest



Herbicide damage vs. grub damage



Mower damage

Diagnosing Problems

- Just because you see a pest doesn't mean it caused the damage.
- Not all damage needs to be treated.
- Pests may no longer be present.
- Pest may be difficult to find
- Irrigation problems and nutritional deficiencies



Katydid damage



Stink bug damage



Belowground damage from root-knot nematode

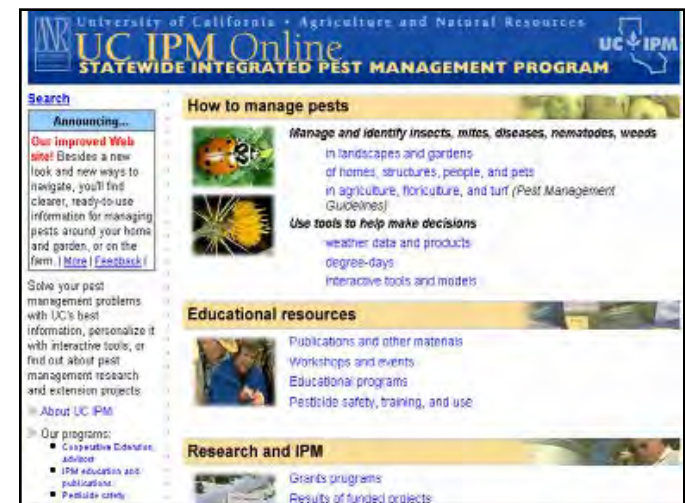


Damping off from fungi, primarily weather-related

Getting Help— Sources of Information

Science-based

- University sources
 - Web site address ends in “.edu”
 - www.ipm.ucanr.edu
 - UC Cooperative Extension
- Government sources
 - Often end in “.gov”
 - US EPA
 - DPR www.cdpr.ca.gov



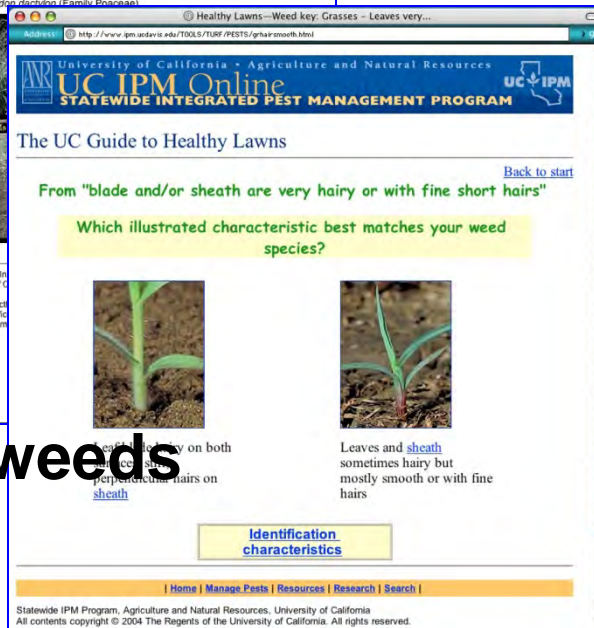
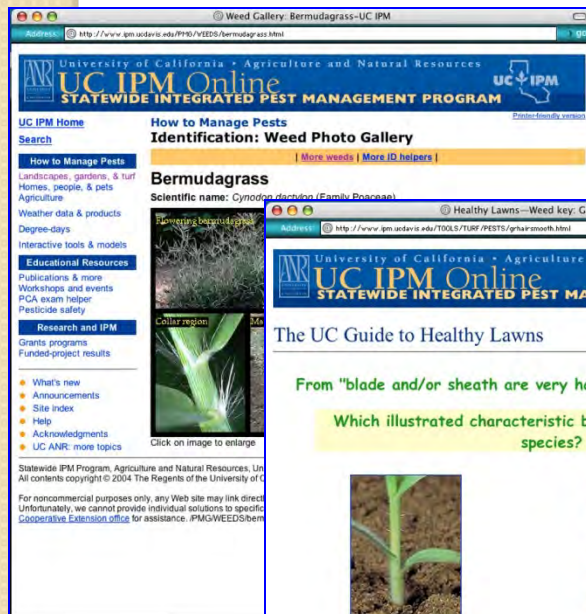
Resources to help you identify pests

www.ipm.ucanr.edu

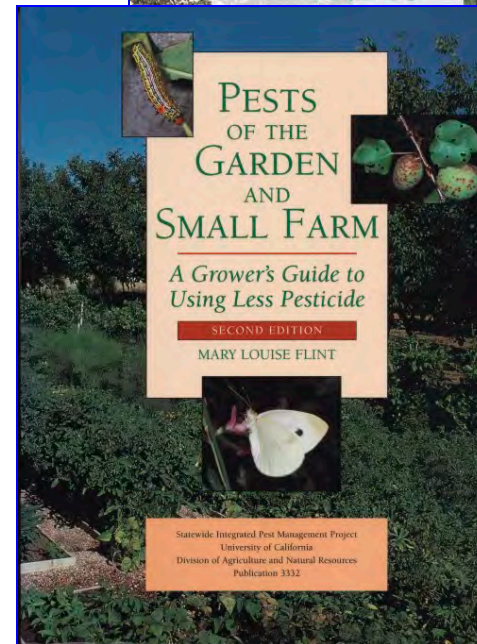
Pest
notes



Weed photo
gallery



Key to weeds
in turf



UC IPM
Publications



Be on the lookout

- Monitor regularly

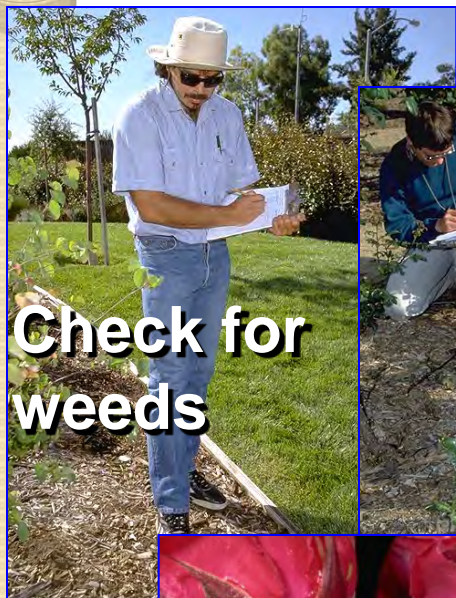
Mice

droppings

Rat droppings



Monitoring devices



Check for
weeds



Inspect
plants



Powdery growth



Cockroach
trap



Yellow
sticky trap
for
whiteflies
or aphids



Hand lens

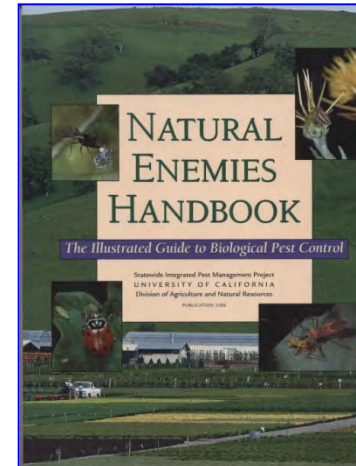
Biological control



*Use of natural enemies
to control pests*

Predators

- Attack, kill, and feed on other prey



Pathogens

- Cause disease

Parasites

- Live and feed in a larger host



Armyworm
killed by virus

Biological Control Arthropods

Controlling insects and
mites with:

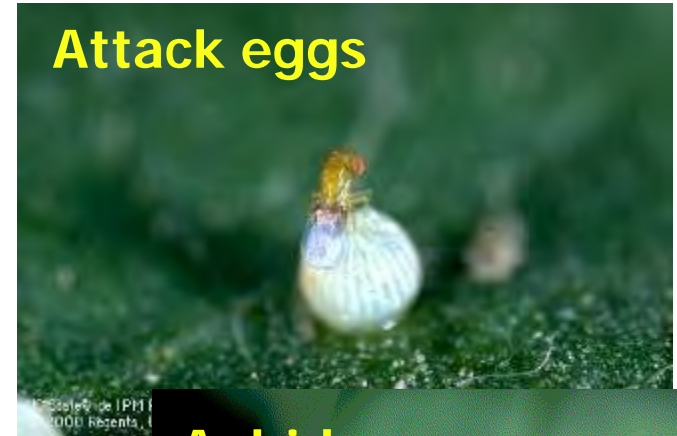
- Pathogens
- Predators
- Parasites



Parasites

- Female lays egg in host. The immature kills the host during its development, killing only one host.
- Adult is free living.
- Attack all stages: eggs, nymphs, larvae, pupae.

Attack eggs



Aphids



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Exit hole indication of parasitism



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Attack larvae



Parasitic groups:

- Wasps
- Tachinid flies



Predators

- Feed on more than one individual host during their lifetime.
- Many feed on a variety of insects and mites, pollen, nectar, and honeydew



Identification

Good or Bad?

Many beneficial insects such as the syrphid fly larvae and the cecidomyid midge look like plant pests, but are actually effective predators of aphids.



When are pesticides needed?



- When pests are causing intolerable damage
- Nonchemical methods aren't effective

How to know?

- Identify your pest
- Assess the problem
- Research and consider alternatives

If you use pesticides

- Choose the least-toxic effective material
- Use in combination with other methods
- Follow label directions carefully
- Consult UC IPM Pest Notes



WEED MANAGEMENT IN LANDSCAPES

Integrated Pest Management in the Home and Landscape



This site identifies the most effective and least-toxic methods for controlling weeds in the landscape. It provides information on the biology, ecology, and management of weeds in the landscape. The site also provides information on the biology, ecology, and management of weeds in the landscape.

WEED MANAGEMENT
Integrated Pest Management in the Home and Landscape

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YELLOWJACKETS AND OTHER SOCIAL WASPS

Integrated Pest Management in and around the Home

Only a few of the very large numbers of wasps species in California have a social structure. These social wasps are the yellowjackets, bumblebees, and hornets. The yellowjackets are the most common of the social wasps in California. They are found in the landscape in the spring and summer months. They are found in the landscape in the spring and summer months.

YELLOWJACKETS
Integrated Pest Management in and around the Home

YELLOWJACKETS
Integrated Pest Management in and around the Home

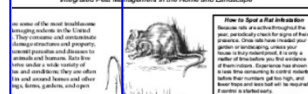
YELLOWJACKETS
Integrated Pest Management in and around the Home

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YELLOWJACKETS
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RATS

Integrated Pest Management in the Home and Landscape



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PEST NOTE

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Publication 74106
January 2003



IPM for slugs and snails

1. Identify the pest

Holes in fruit



Holes in leaves



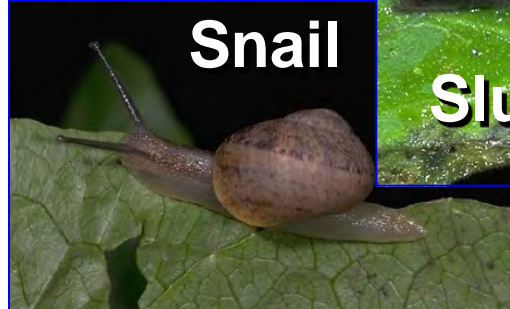
Slime trail



Feces



Snail



Slug



2. Determine if this pest is a problem you can't tolerate

- Evaluate damage
- Consider types of plants
- Search hiding places

IPM for aphids

1. Identify the pest

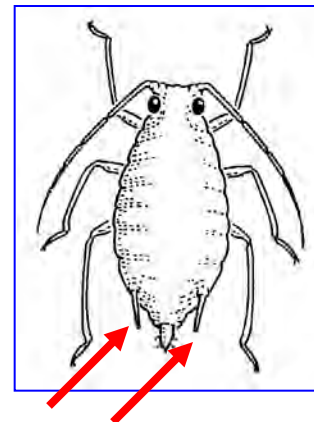
Curled leaves



Honeydew and sooty mold



**Many different
aphid species**



2. Determine if this pest is a problem you can't tolerate

- High number of aphids?
- No natural enemies?
- Know facts about biology

IPM for aphids

3. Identify the conditions that cause aphids to thrive

- Plants such as apples, roses, vegetables
- New lush plant growth
- Destruction of natural enemies by pesticides
- Protection by ants



Lacewing
larva



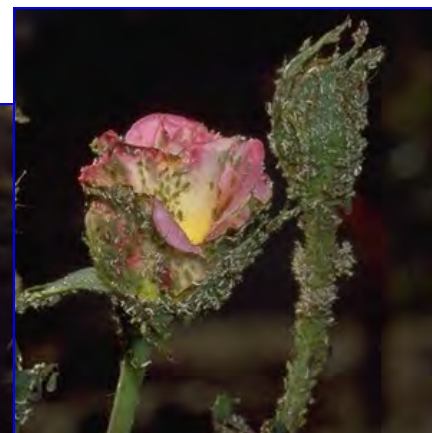
Parasites



Syrphid larva



Sticky tree wrap



How can you change these conditions?

- Choose plants not prone to aphid problems
- Avoid overfertilizing plants
- Avoid pesticides that kill natural enemies
- Keep ants off plants

IPM for powdery mildew

1. Identify the pest

**Powdery spots
on leaves**



2. Determine if this pest is a problem you can't tolerate

- **Are your plants known to be susceptible?**

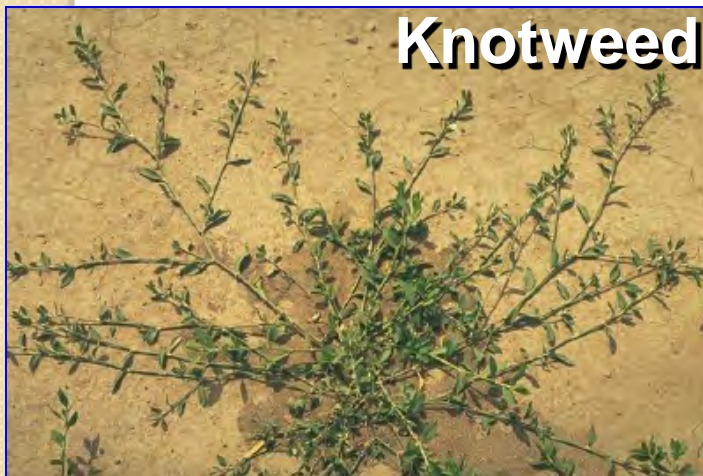
Russeted scars



IPM for weeds

1. Identify the pest

- Know which weeds are invading
- Use tools on the UC IPM web site



Knotweed

Dandelion in turfgrass



2. Determine if this pest is a problem you can't tolerate

- Weeds in planting beds
- Perennial weeds

IPM for weeds

3. Identify the conditions that cause weeds to thrive

- Sources of weed seeds or propagules
- Unplanted areas
- Poorly maintained plantings



Mulches



Mow strips



How can you change these conditions?

- Destroy weedy areas around gardens
- Don't bring in seeds or propagules
- Plant dense plantings
- Use mulch, mow strips, concrete strips
- Select competitive plants
- Install low-output irrigation systems
- Water, fertilize, prune, mow properly

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Home, Garden, Turf & Landscape Pests



Agricultural Pests





Natural Environment Pests




Exotic & Invasive Pests






Enter Search Terms

 Search

UC IPM

/ Home, garden, turf and landscape / Plant problem diagnostic tool

Plant problem diagnostic tool

 HELP

Plant Types

Plant Names

Plant Parts

Damage

Select plant types for list of results

Reset All

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Welcome to UC IPM's Plant Problem Diagnostic Tool

To begin, choose the affected plant from the **Plant Types** photos displayed in the center of the page. Click on the photo directly or use the "+ Add to my list" button. Your selection will show in the left-hand column and will be grayed out in the main photo area. Remove any selections that do not apply by clicking on the red **X**.


Next, click on the Plant Names bar on the left to view a list of plants in your chosen category. Scroll down through the choices until you find your affected plant, then add the plant to your list. *Note: you may also view bigger versions of images by clicking on the magnifying glass icon.*

Once you've selected your plant, choose the **Plant Parts** bar from the left hand menu and select one or more of the affected plant parts. Click on **Damage** to see descriptions, then select the damage type(s) that apply to your plant to add them to the list.

Finally, click the **View Results** bar underneath your selections in the left hand panel to see the diagnoses.

The more you can narrow down your selections by choosing plant names, plant parts, and damage, the fewer potential results you'll get and the faster you will be able to find the pest or problem affecting your plant. If your search is too broad, the results will be large.

To reset your search and start over, select the **Reset All** bar. To return to the main UC IPM Home and Landscape page, click on "Home, garden, turf and landscape" in the green bar at the top of the page.

 CLOSE



Enter Search Terms

Search

UC IPM / [Home, garden, turf and landscape](#) / [Plant problem diagnostic tool](#)

Plant problem diagnostic tool



Plant Types >

Plant Names

Plant Parts

Damage

Select plant types for list of results

Reset All

Select plant types

+ Add to my list



Flowers

+ Add to my list



Fruit trees, nuts, berries, and
grapevines

+ Add to my list



Trees and shrubs

+ Add to my list



Vegetables and melons

+ Add to my list



Cauliflower

+ Add to my list



Corn

+ Add to my list



Cucumbers

+ Add to my list



Eggplants

+ Add to my list



Garlic

+ Add to my list



Lettuce

+ Add to my list



Onions

+ Add to my list



Peas

+ Add to my list



Peppers

+ Add to my list



Potatoes

+ Add to my list



Pumpkins

+ Add to my list



Spinach

+ Add to my list



Squash

+ Add to my list



Tomatoes

+ Add to my list



Watermelon

Reset All

Agriculture and Natural Resources, University of California

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Plant problem diagnostic tool



Plant Types

Vegetables and melons

Plant Names

Tomatoes

Plant Parts

Leaves

Damage

View Results (26)

Select damage

+ Add to my list



Leaves / Curled, cupped, folded, rolled, twisted

+ Add to my list



Leaves / Defoliate, skeletonize

+ Add to my list



Leaves / Deformed, distorted, dwarfed

+ Add to my list



Leaves / Dieback of tips, margins

+ Add to my list



Leaves / Discolored, necrosis, chlorosis

+ Add to my list



Leaves / Drop, ding to branches

+ Add to my list



Leaves / Galls, swell, rough

+ Add to my list



Leaves / Holes, notching, scalloped, circular, irregular

+ Add to my list



Leaves / Mines, trails

+ Add to my list



Leaves / Ragged, tattered, crinkled, leathery

+ Add to my list



Leaves / Shrivel, droop, withered, wilted

+ Add to my list



Leaves / Specks, flecks, dots, stippled

+ Add to my list



+ Add to my list



+ Add to my list



+ Add to my list





Enter Search Terms

Search

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UC IPM / Home, garden, turf and landscape / Plant problem diagnostic tool

Plant problem diagnostic tool



Results for: vegetables and melons, tomatoes, leaves, specks, flecks, dots, stippled

> Leafminers

[Thrips](#)

[← Back to diagnostics](#)

Leafminers—*Liriomyza* spp.

On vegetables, the most common leafminers are the larvae of small flies belonging to the genus *Liriomyza*, including the vegetable leafminer (*L. sativae*), serpentine leafminer (*L. trifolii*), and the pea leafminer (*L. langel*).

Identification

Adult leafminers are small, active, black flies often with a prominent yellow triangle between the bases of the wings. The head behind the eyes is mostly black. Other species may have the thorax covered with overlapping bristles that give fresh specimens a silvery gray color with the area behind the eyes yellow. Larvae are yellow cylindrical maggots that feed beneath the leaf surface. The yellowish maggots and brown, seedlike [pupae](#) of the two species are too similar to distinguish.

Life cycle

In warm weather, leafminers may be more active. The life cycle is only 2 weeks long. Eggs are inserted into leaves and larvae feed between leaf surfaces, creating a "mine." At high population levels, entire leaves may be covered with mines. Mature larvae leave the mines, dropping to the ground to pupate. There can be five to ten generations per year. Development continues all year, the population moving from one host to another as new host plants become available each season.

Damage

Leafminers attack many different vegetable and flower hosts, including cole crops, cucurbits, tomatoes, peas, beans, aster, begonia, dahlia, impatiens, lily, marigold, petunia, and verbena. Adult female leafminers puncture leaves and sometimes petals to feed on exuding sap. These punctures eventually turn white, giving foliage a stippled or speckled appearance. The most obvious evidence of leafminers is the twisting trails (or mines) the larvae leave as they feed beneath the leaf surface. The mine becomes longer and wider as the larva grows. Mining usually has little impact on plant growth and rarely kills plants. Unusually heavy damage can slow plant growth and may cause infested leaves to drop. Damage will not be serious on most plants older than seedlings, although it may make spinach or chard unsightly.

Solutions

Leafminers rarely require treatment in gardens. Provide proper care, especially irrigation to keep plants vigorous. Clip off and remove older infested leaves. Plant resistant species or varieties. Small seedlings can be protected by [protective cloth](#). On plants such as cole crops, lettuce, and spinach, clip off and remove older infested leaves. Leafminers are often kept under good control by [natural parasites](#). Insecticides are not very effective for leafminer control.



Leafminer adult



Adult serpentine leafminer



Leafminer mines and feeding punctures



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