

# **Diagnosing Tree Crop Problems in the Field**

**Joseph Grant and Louise Ferguson**  
**University of California Cooperative Extension**

***Training Conference***  
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# Diagnosing plant pests, diseases and disorders

## **FIRST, MUST KNOW:**

Correct plant identification

- Healthy plant appearance
- The diseases, insects and other problems that can affect the crop

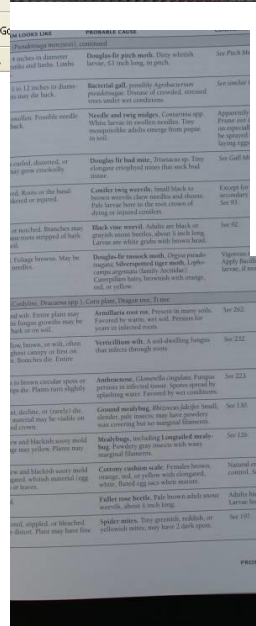


50th  
ANNIVERSARY EDITION

*Westcott's*  
*Plant Disease*  
*Handbook*

2nd Edition

R. Kenneth Horst



**LEAF AND STEM DISEASES AND DISORDERS**

**Powdery mildew** is caused by the fungus *Sphaerotheca pannosa* var. *roseae*. It is recognized by its white to gray powdery growth on leaf undersides and occasionally on petals. Leaves may distort and die. Powdery mildew does not require free water on the plant surfaces to develop, and is active during California's warm, dry summers. Overhead sprinkling (irrigation or washing) during midday may limit the disease by disrupting the daily spore-release cycle, yet allows time for foliage to dry. The pathogen requires *biotic triage* in order to survive, so pruning, collecting, and disposing of leaves during the dormant season



**Plagas y enfermedades  
de los citricos, Segunda Edicion**  
\$55.00

# Biotic vs. Abiotic Causes

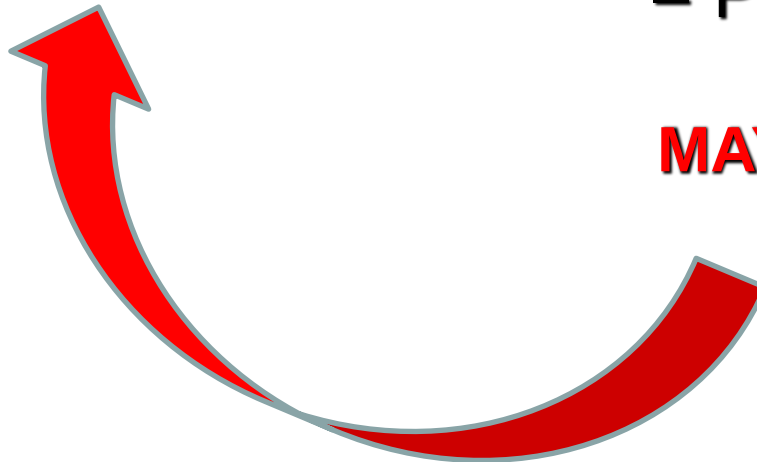
- **Biotic**

- Fungi
- Bacteria
- Viruses
- Phytoplasma
- Nematodes
- Insects & Mites

- **Abiotic**

- Soil moisture extremes
- Temperature extremes
- Salts
- Air pollution
- Wind, light effects
- Mechanical damage
- Pesticide damage

**MAY PREDISPOSE TO  
BIOTIC!**





# **QUESTIONS TO ASK**

- History
- Situation
- Spatial variability
- Symptom expression



# ***QUESTIONS TO ASK***

- **History: of orchard and problem**
  - *Of the ground and orchard*
  - *Adjacent properties*
  - *What is rootstock and scion*
  - *When first noticed?*
  - *How long? Chronic or One-time*
  - *Progression in tree or field?*

# QUESTIONS TO ASK

## ◦ Situation

- Age and production
- *Soil type and condition*
- *Soil and water quality*
- *Leaf Analysis*
- *Weather around time symptoms developed?*
- *Cultural practices*
- *Fertilizer, pesticides, irrigation applied*

# QUESTIONS TO ASK

## • Spatial variability

- % of field / orchard affected?
- Pattern?
- Other plants in field / orchard affected?





**Pattern in the orchard,  
or random?  
or scattered?  
or clumped?**







N





# ***QUESTIONS TO ASK***

## ◦ **Symptom expression**

- *What plant parts are affected?*
- *Top-down? Bottom-up?*
- *Where is PRIMARY site of injury?*
- *Progressing in severity or on plant over time?*



# What plant part plan affected

Entire  
canopy



Individual  
branches





# Where is the PRIMARY site of injury?



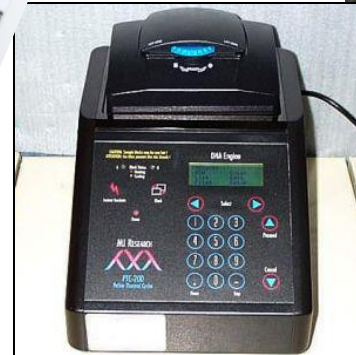
# Diagnostic Equipment & Tools

- **Field**

- POCKET KNIFE
- HAND LENS
- PLASTIC BAGS
- NOTEBOOK
- SHOVEL
- CAMERA

- **Lab / Office**

- MICROSCOPE
- DISSECTING SUPPLIES
- CULTURING
- NOTEBOOK
- ANALYTICAL EQUIPMENT





# Method of Recording Information

● MASTER GARDENER CALLER FORM DATE \_\_\_\_\_

TAKEN BY MG \_\_\_\_\_

CALLER NAME \_\_\_\_\_ PHONE \_\_\_\_\_

ADDRESS \_\_\_\_\_

PLANT & PROBLEM \_\_\_\_\_

SAMPLE SUBMITTED: ☐ YES ☐ NO (COMMENT) \_\_\_\_\_

PLANT AGE \_\_\_\_\_ PLANT SIZE \_\_\_\_\_ OTHER PLANTS AFFECTED \_\_\_\_\_

WATERING METHOD ☐ DRIP ☐ FLOOD ☐ SPRINKLE ☐ OTHER \_\_\_\_\_

How OFTEN? \_\_\_\_\_ How LONG? \_\_\_\_\_

SOIL TYPE: ☐ CLAY ☐ LOAM ☐ SANDY

EXPOSURE: ☐ FULL SUN ☐ PART SUN ☐ SHADE N, S, E, W AND REFLECTIVE (CIRCLE ONE)

CHEMICAL APPLICATIONS TO SOIL OR PLANTS: \_\_\_\_\_

● MG RESPONSE/COMMENTS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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CALL BACK DATE \_\_\_\_\_ BY \_\_\_\_\_ (COMMENT) \_\_\_\_\_

DATE \_\_\_\_\_ BY \_\_\_\_\_

DATE \_\_\_\_\_ BY \_\_\_\_\_

□ COMPLETED DATE \_\_\_\_\_ BY \_\_\_\_\_

● Write down the information!!!



# Biotic vs. Abiotic Causes

- **Biotic**

- Fungi
- Bacteria
- Viruses
- Phytoplasma
- Nematodes
- Insects & Mites

- **Abiotic**

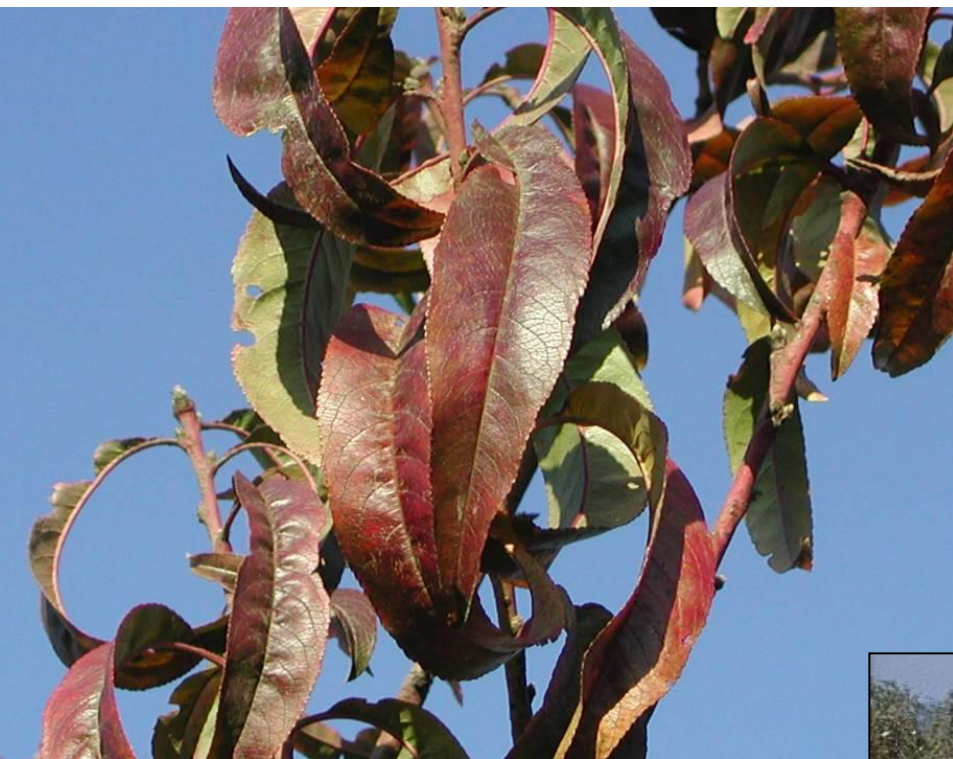
- Drought
- Over watering
- Freeze / Frost
- Sunburn
- Salts
- Nutrient deficiencies
- Herbicide toxicity/ injury
- Mechanical damage

- ***History***
- ***Situation***
- ***Spatial variability***
- ***Symptom expression***









- **History**
- **Situation**
- **Spatial variability**
- **Symptom expression**





- **History**
- **Situation**
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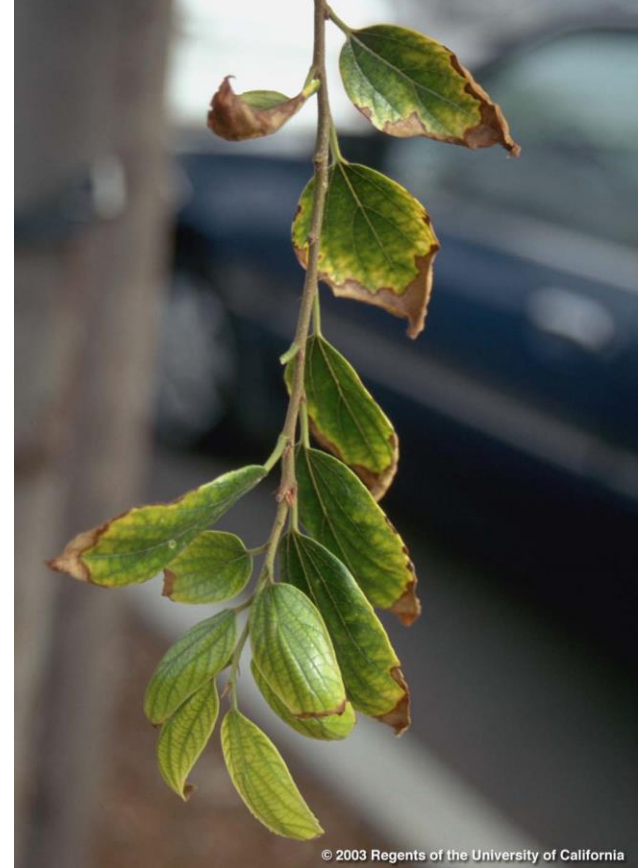
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- **History**
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- **History**
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- History
- Situation
- Spatial variability
- Symptom expression







- **History**
- **Situation**
- **Spatial variability**
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- › ***History***
- › ***Situation***
- › ***Spatial variability***
- › ***Symptom expression***



# Laboratory tests for Abiotic Causes

## Soil, water

pH testing

Nutrient analysis

Soluble salts analysis

Analysis for chemicals

## Plant tissue tests

Nutrient analysis

Analysis for chemicals

# Biotic vs. Abiotic Causes

## • Biotic

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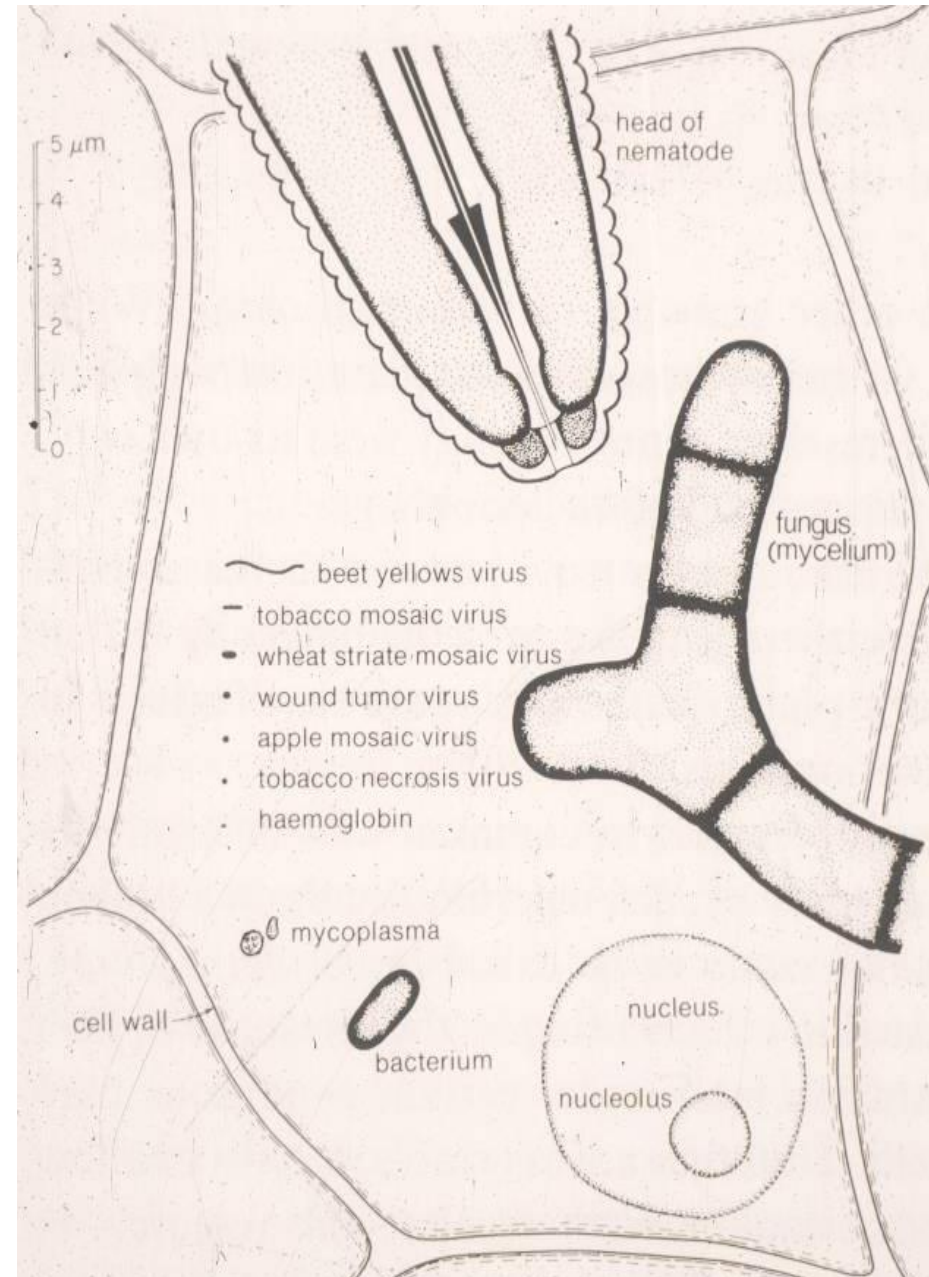




# Plant Pathogens

- Fungi
- Bacteria
- Viruses

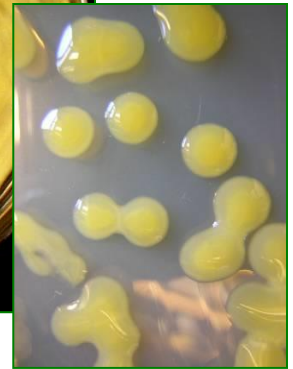
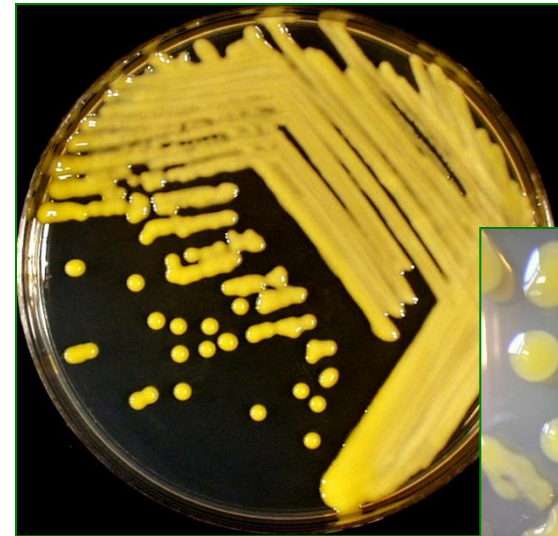
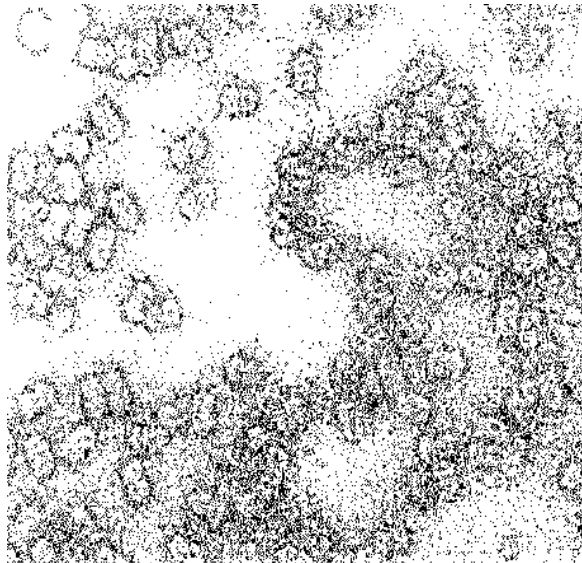
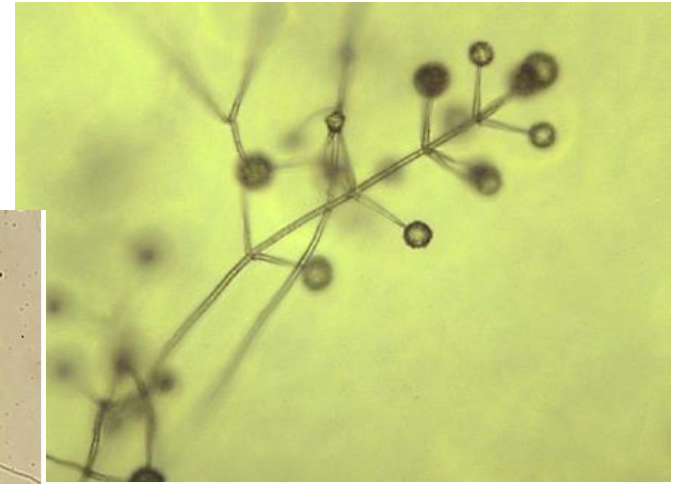
## Nematodes



# Plant Pathogens

- Fungi
- Bacteria
- Viruses

## Nematodes





# Symptoms and Signs

- Plants respond to infection by plant pathogens with disease **symptoms**
- **Signs** are the pathogen or its parts or products seen on the host plant

Diagnosis based on symptoms alone can be very difficult

# **Disease symptoms can be variable**

- **More than one problem**
- **More than one pathogen**
- **Pathogens vary in virulence**
- **Environmental conditions affect symptom expression**



# Symptoms and Signs



## **FUNGI**

- Leaf spots usually round, not vein-limited
- Alternating zones of light and dark tissue
- Spores or mycelia may be present

# Signs: FUNGI



Powdery mildew form mycelia and spores on tissue surface

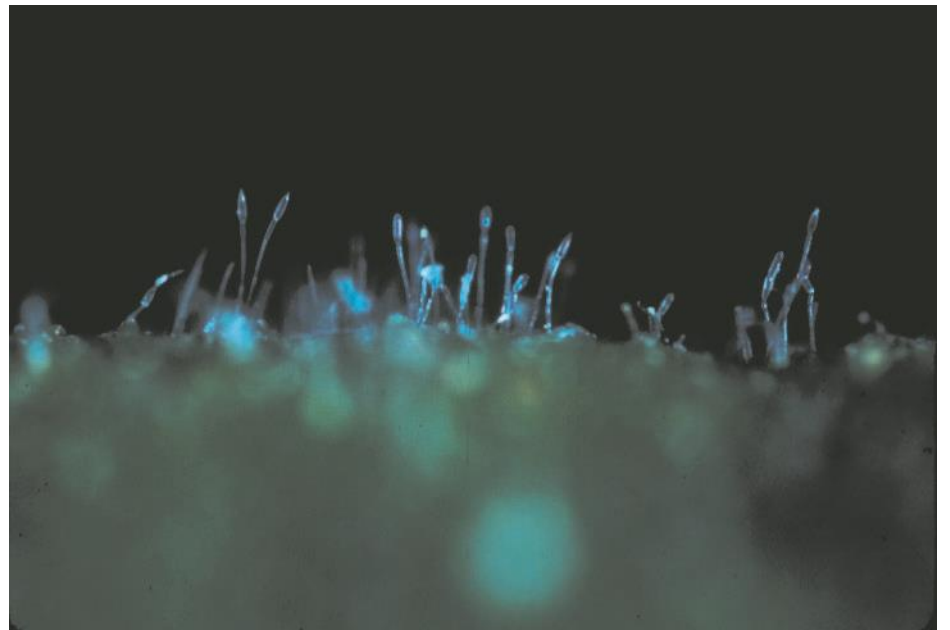






## Tomato Powdery Mildew

Symptoms and signs



# Signs: FUNGI

Brown rot (*Monilinia spp*)



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Sooty Mold



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# Signs: FUNGI



## Fruiting bodies

- Shape of fruiting body aids in identification





# Symptoms and Signs



## BACTERIA

- Leaf spots often dark and water-soaked
- Vein-limited, angular shape
- Bacterial ooze, streaming under microscope



# Symptoms ~~and Signs~~



## VIRUS Symptoms

- Stunted & distorted growth
- Mosaic, mottle, curling, yellowing
- Abnormal flowers & fruit
- Can be confused with nutrient deficiencies, herbicide damage





# Symptoms

## CANKERS

- Sunken or swollen or both
- Fungi OR bacteria





# Symptoms: Vascular discoloration

Verticillium wilt in...



Maple



Chinese pistachio



Tomato

# Symptoms



## BLIGHT, DIEBACK

- Blight = rapid death or dieback. Also from coalescing leaf spots, e.g., early blight of tomato
- Fungal OR bacterial causes



# Symptoms

## ROOT ROT

- Darkening and softening of roots or crown
- Yellowing, stunting, death of plant
- Fungal OR bacterial causes





# Symptoms

## GALLS

- Bacteria
- Nematodes



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Root Knot  
Nematodes



# Insects & Mites

- Easiest to diagnose
  - Damage
    - Chewing, sucking, boring
  - Specific to crop
  - Often readily seen



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## Surface or internal feeding insects



# Leaf chewing and folding insects



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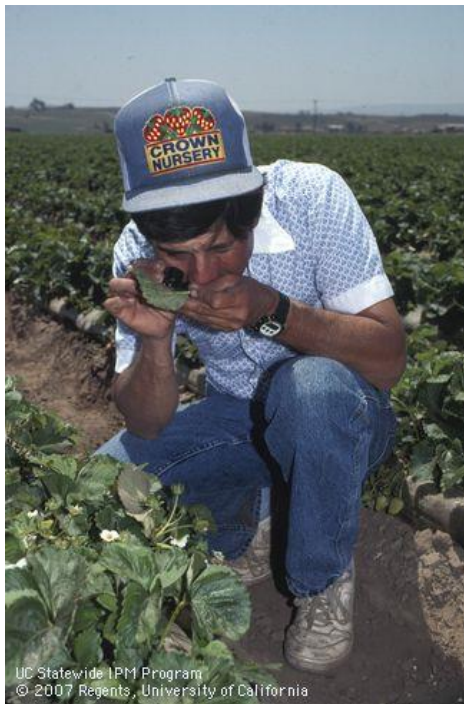


# Sucking insects





# Mites



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Leaf “silvering” ,



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“bronzing”, and webbing



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# Sampling Techniques: Collecting Specimens

- ✓ Important for accurate diagnosis
- ✓ All specimens should be fresh, kept refrigerated
- ✓ Collect the whole plant if possible
- ✓ Submit samples showing all stages of problem



# Sampling techniques

- ✓ Don't destroy signs or symptoms
- ✓ Roots: Remove soil, include tissue above and below visible lesions
- ✓ Stem and leaf: Include tissue above and below visible lesions
- ✓ Flower, fruit, seed: Collect the entire organ



# Sampling Techniques: Handling and Packing

- ✓ Identify/label correctly every specimen
- ✓ Package delicate material in a sturdy box
- ✓ Do not add water or wet paper towels
- ✓ Ship immediately overnight and early in the week









- 
- ***History***
  - ***Situation***
  - ***Spatial variability***
  - ***Symptom expression***

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