

Plant Problem Diagnosis



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Overview

A black and orange caterpillar with long spines is perched on a green plant stem. The caterpillar has a black body with bright orange spots and long, thin, purple spines extending from its back. The background is a dense thicket of green leaves and stems, some with white variegation.

- ▣ Basic Definitions
- ▣ Abiotic versus Biotic
- ▣ Diagnosing Plant Problems
- ▣ Diagnosing Insect Problems
- ▣ Diagnostic Tools & Information Sources

Basic Definitions

- ▣ Plant Pathology
 - the study of the microorganisms and environmental factors that cause disease in plants
- ▣ Plant Disease
 - any deviation in normal functioning of a plant caused by some type of pathogen

Pathogen: any agent that causes disease

Biotic

- caused by living agents
- can be transmitted from one plant to another
- fungi, bacteria and mollicutes, viruses and viroids, nematodes, protozoans, parasitic higher plants, allelopathy

Abiotic

- caused by non-living agents
- cannot be transmitted from one plant to another
- temperature, water, light, air pollution, nutrient deficiencies, mineral toxicities, soil pH, pesticides, cultural practices

Primary versus Secondary

- ▣ Primary = the main or initial problem
- ▣ Secondary = follow on problems
- ▣ Example
 - Abiotic factors may weaken or stress plants
 - Increasing susceptibility to biotic agents
 - In this case:
 - ▣ Abiotic = Primary
 - ▣ Biotic = Secondary

Symptoms versus Signs

Symptom - characteristic signature of the pathogen or insect and host resulting from the interaction of specific pests and hosts

Sign - the actual causal agent of the disease or the presence of insects or their products

Host specificity - pests that infect a limited number of related or unrelated hosts

Symptoms

- ▣ Change in appearance or functioning of the plant
 - Chlorosis or yellowing
 - Stippling



Interveinal chlorosis



Stippling

Signs

- ▣ Actual evidence of the causal agent
 - Mycelia, frass, spores, ooze



Comparison of Problem Types

Abiotic

- Symptoms - usually uniform in symptom expression and general distribution
- Signs - none
- Host Specificity - similar symptoms on two or more unrelated hosts
- Spatial Distribution - usually random

Biotic

- Symptoms - produced on specific plant parts, progressive invasion of tissues
- Signs - fruiting bodies and other structures
- Host Specificity - usually host-specific on related hosts
- Spatial Distribution - usually show a clumping distribution pattern

Abiotic Examples

1. Water
2. Light
3. Temperature
4. Pesticides
5. Cultural Practices
6. Nutrient deficiency and toxicity
7. Salt
8. Air pollution



The most common plant health problem encountered in Central and Southern AZ is related to...

1. Poor pruning
2. Insects
3. Fungus
4. Improper irrigation
5. Bacteria
6. Virus
7. Parasitic plants
8. Nematodes

What is the first step in solving a plant problem?

1. Determine what is normal for the plant
2. Inquire about irrigation practices
3. Identify the plant
4. Recommend corrective pruning
5. Go to a big-box nursery department and ask for a product recommendation

Problem: My plant is covered with a white fungus



Cochineal scale, *Dactylopius coccus*
on prickly pear, *Opuntia* species

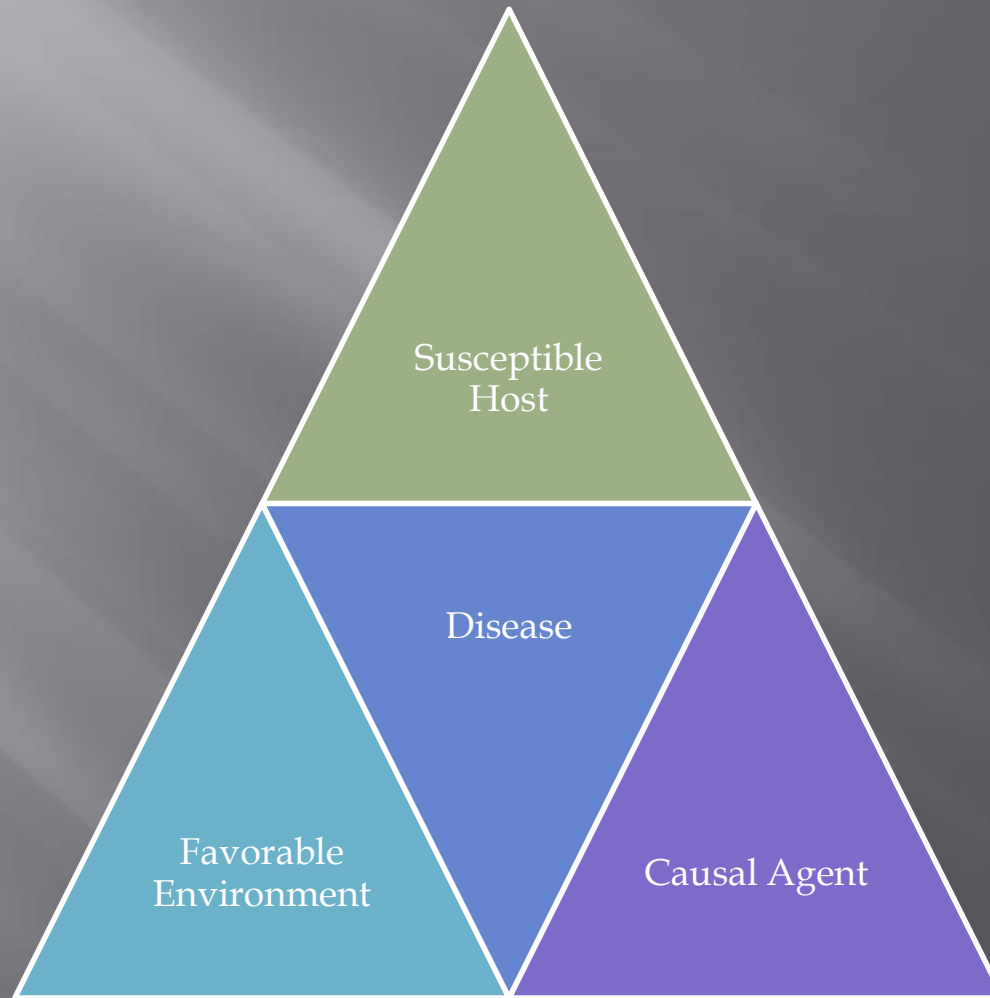
- Solution:
 - Correctly identify the plant
 - Determine common problems
- Never attempt to diagnose a disease over the phone
- Even if you are 99% sure

What three things must be present for a disease to occur in plants?

1. Bacteria, fungi, viruses
2. Water, high temps, shade
3. Host, pathogen, favorable environment
4. Salinity, fungus, high pH

Plant Disease Triangle

All three factors must be present for disease to occur



Yellowing of the leaves may be caused by

1. Nitrogen deficiency
2. Iron or zinc deficiency
3. Overwatering
4. Underwatering
5. All of the above



What is normal for that plant?



COTTONWOOD IN WINTER



BERMUDAGRASS IN WINTER

What are the Requirements for a Specific Plant?

- ▣ Full or partial sun
- ▣ Alkaline or acid soil
- ▣ Frequent fertilizer
- ▣ Irrigation
- ▣ Pollinator



Look for Patterns

- ▣ Are all species affected?
- ▣ Location on the property
- ▣ Location on the plant
- ▣ Sudden onset
- ▣ Gradually over time



Cultural practices that lead to problems:

- ▣ Over pruning
- ▣ Over or under watering
- ▣ Too much or too little light
- ▣ Over fertilizing
- ▣ pH or salinity issues



Reasons to Prune



- ▣ Plants that have outgrown the space
- ▣ Safety related issues
 - Plants that encroach over sidewalks
 - Obstruction lines of sight at intersections and driveways or that block signage
 - Potential to injure or damage
- ▣ Damaged

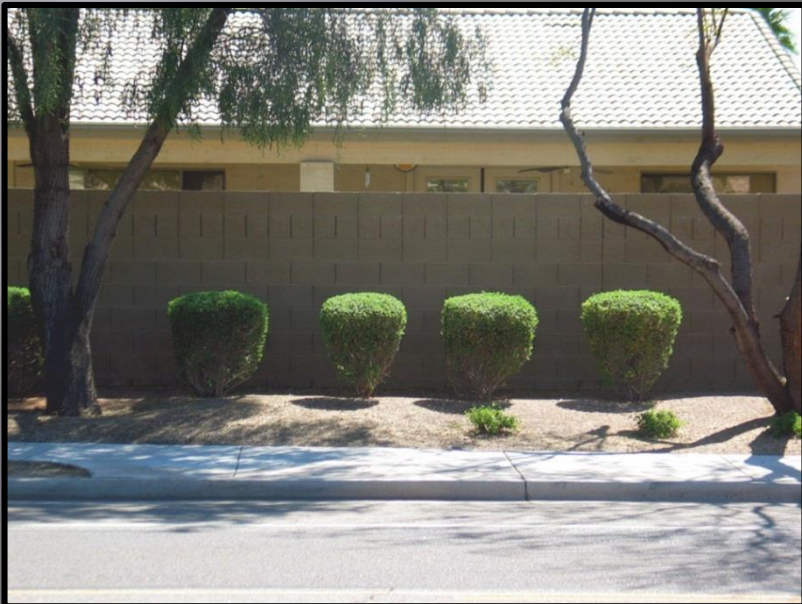
Benefits of Proper Pruning

- ▣ Grow to mature size and natural shape
- ▣ Water conservation
- ▣ Normal growth cycle
- ▣ Less trips to landfill
- ▣ Endure periods of stress better
- ▣ The site will look better throughout the year



Shapes and Flowers

- ▣ Allow shrubs and groundcovers to fill spaces
- ▣ Who asked for beer cans, meatballs or other shapes?
- ▣ Knowledge of blooming periods is necessary



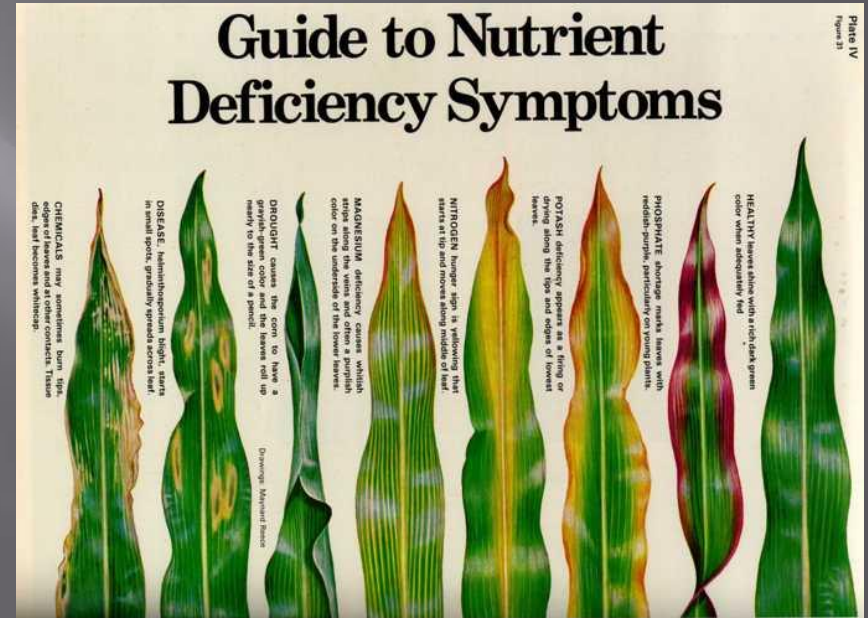
Pruning Calendars

SHRUB PRUNING CALENDAR

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1st Half												
2nd Half												
	Grasses Oleanders to control size	Grasses Sages Tecomas	Frost sensitive i.e. Lantana, Bougainvillea	Cassia, Dalea, Acacia redolens, Salvias	Calliandra, Brittle Bush	Oleander after blooming Yucca and Hesperaloe flower stalks					Mexican Birds Red Birds	Grasses, Sage
	Winter		Spring			Summer			Fall			Winter

Pruning shall be done once during the period indicated that is appropriate for that plant type - i.e. Grasses may be pruned one time between December and February

Nutrient deficiency



Herbicide injury



Hail damage

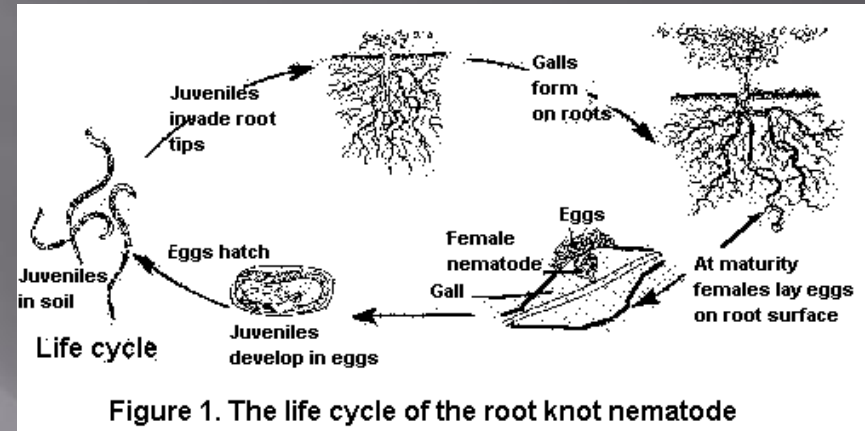


Salt burn



Root-knot Nematodes

- Symptoms:
 - Small, stunted
 - Chlorotic
 - Wilt even when amply watered during warm weather
 - Poor fruit set
 - Fruits small
 - Presence of knots on roots



Phymatotrichopsis omnivora

- ▣ Texas root rot
- ▣ Only affects mature dicots
- ▣ Affects over 2300 plant spp.
- ▣ Can survive in the soil
- ▣ Symptoms: wilting and rapid death during hot months, dead leaves remain attached to plant
- ▣ Manage with immune or resistant species
 - Monocots
 - Palo verde, mesquite, desert willow



Wood rots

- ▣ Soil borne fungi
- ▣ Transmitted through wounds in roots
- ▣ Hosts include ash, sumac, citrus, mesquite, olive, oak, pyracantha and more!
- ▣ Can move from tree to tree with root contact
- ▣ Mostly attacks dead cells
- ▣ Once conch visible the damage is extensive
- ▣ No treatment
- ▣ Minimize wounding, stress, replanting same species



Ganoderma fruiting bodies

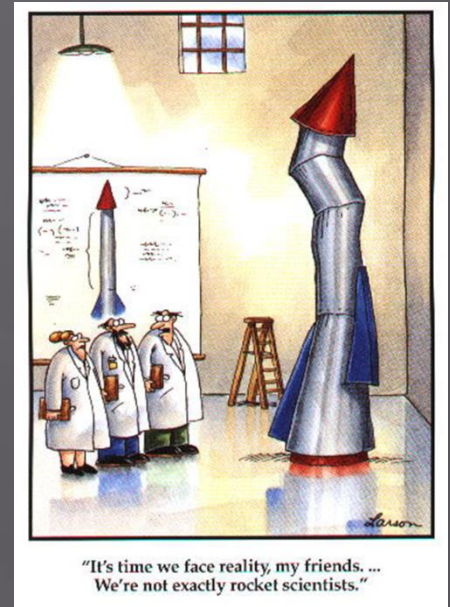
Bacterial Necrosis of Saguaro

- ❑ Caused by *Erwinia* bacterium
- ❑ Found in cholla, prickly pear, barrel, organ pipe
- ❑ Enters through wounds & natural openings
- ❑ If lesion is small, remove and disinfect with 10% bleach
- ❑ If large, consider removing the cactus



Disease diagnosis: Not for beginners!

- ▣ Most problems are self inflicted
 - Bad plant choice
 - Bad plant location
 - Bad plant care
- ▣ If you can rule out the above
 - Ask the client to submit sample for further study
 - It is too difficult to diagnose disease without



Plant Pathology Resources

- University of Arizona Extension Plant Pathology:
<http://cals.arizona.edu/PLP/plpext/>
- The American Phytopathological Society:
<http://www.apsnet.org/>
- Western Plant Diagnostic Network:
<https://www.wpdn.org/>

Diagnosing Insect Damage

- Chewed leaves or blossoms
- Discolored leaves or blossoms
- Distorted leaves, branches, or trunks
- Dieback of shoots, twigs, or branches
- Products of insects and mites



Types of Insect Injury

- Chewing >> beetles, caterpillars, grasshoppers, etc.
- Piercing sucking >> aphids, scale, leafhoppers, etc.
- Internal feeders >> leaf miners, borers, etc.
- Subterranean >> wireworms, root maggots, etc.
- Egg laying >> cicadas, gall insects, etc.
- Nest material >> leaf cutter bees, etc.
- Disease vector >> aphids, leafhoppers, bees, beetles, etc.



Effective Diagnosis

- Recognition of symptoms
 - Regular monitoring
 - Record keeping
- Accurate identification
 - Close examination
 - Consulting experts as needed
- Knowledge of pest life cycle
 - Identify susceptible life stages
 - Determine location for management
- Distribution of pest population
 - Are there enough of them to be a problem?
 - Are they wide spread or spreading?

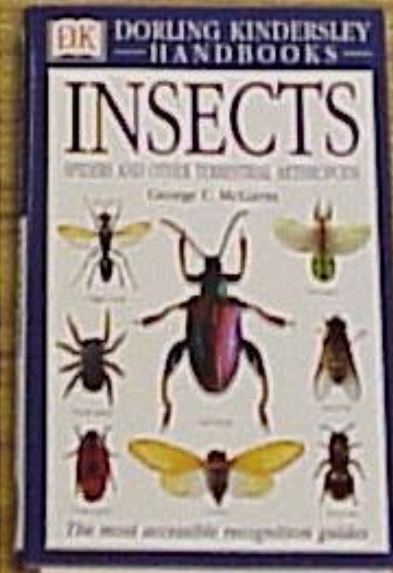
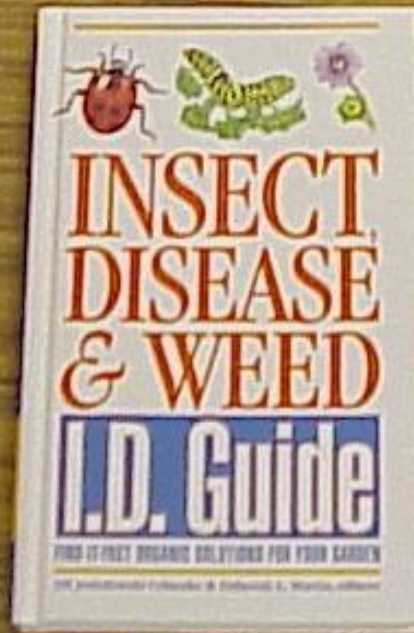


Determining Insect Pest Status

- First goal: identify to Order level (such as bee, beetle, fly)
 - antennae, wings, mouthparts
 - shape, texture, size, color
 - life stage: egg, larva, pupa, adult
- Then use other clues to determine pest status
 - Host plant
 - Activity and/or damage
 - » feeding, flying, crawling, etc.



Diagnostic Tools



Overview of IPM Options

- Host resistance
- Biological control
- Chemical control
- Cultural control
- Mechanical control
- Do nothing



Sources of Information

- Publications
 - Land-grant Universities
 - OMRI.org
 - BIRC.org
- Community Availability
 - Survey Local Stores/Nurseries
 - Cooperative Extension/MGs
- Dotcom Resources & Catalogs
 - Buyer beware
 - Check for products that have been tested by reputable organizations
 - Ask for data and references

Combined Issue
Fall 2006 Quarterly

The IPM Practitioner

Monitoring the Field of Pest Management

Volume XXVIII, Number 11/12, November/December 2006

2007 Directory of Least-Toxic Pest Control Products

The 2007 Directory is a gateway to more than two thousand useful pest control items (for Quick Access see Box A on page 2 and the Index on page 40). Many of these products, services, or beneficial organisms have come to our attention in connection with articles published in BIRC's *IPM Practitioner* or the *Common Sense Pest Control Quarterly*, through IPM programs designed by our staff, or via recommendations from colleagues.

This Directory is unique because it is compiled by IPM technical experts, includes specific product descriptions, and is organized in concert with the IPM decision-making process (see *The IPM Practitioner* 13(11/12):1-9). All information is current, and is constantly updated on BIRC's computerized database system. It is divided into four management sections: Insects, Plant Disease, Vertebrates, and Weeds. Within each section, information is listed in alphabetical order by specific pest grouping. The IPM decision-making steps used to organize individual pest listings include Identification & Monitoring plus a consideration of Physical, Horticultural, Biological, and Least-Toxic Chemical Control methods.

For each product, specific descriptions are included when applicable, followed by the company name and the product name when available (in parentheses). Addresses and phone numbers of manufacturers and suppliers are listed alphabetically by company name at the end of the Directory. An Index to the Directory follows the List of Addresses.

Feedback and Disclaimer

Two caveats apply to this information. First, to the best of our knowledge, these products, services, and



A *Trichogramma* sp. wasp is laying her egg inside that of a pest caterpillar. *Trichogramma* parasitoids and other commercially available biocontrols, as well as traps, baits, pheromones, and many other products needed for IPM can be found in this Directory.

beneficials are effective and are produced by reputable companies. However, they are used at your own risk, and BIRC makes no guarantees or warranties regarding any listing. To help us maintain quality control, we encourage you to contact us about your experiences, both positive and negative, with any of these companies or resources.

Secondly, all information was current at press time. However, pest control is a rapidly changing field: products come and go, and companies change hands and locations on a regular basis. Therefore, if you fail to reach any of the companies listed here, contact us at PO Box 7414, Berkeley, CA 94707; 510/524-2567; birc@igc.org.

Beneficial Insects

Both domestic and international producers of beneficials found in the Directory are listed by alphabetical order in the List of Addresses at the end of the Directory. Names and addresses of Biobest distributors are listed separately in Box B at the beginning of the List of Addresses, and Koppert distributors are listed in Box C.

Note to BIRC Members

To update product information for our Quarterly members, we are combining the Fall 2006 *Common Sense Pest Control Quarterly* with this issue of the *IPM Practitioner*. Regular production of the Quarterly will continue with the Winter 2007 issue.

Three Cardinal Rules of IPM

- **Know your ecosystem**
- **Scout regularly**
- **Keep good records**



Questions?

