INSECTS AND DISEASES AND OTHER TREE PEST PROBLEMS

MY GOALS FOR US TODAY

- **To improve our diagnostic skills and diagnostic mindset.**
- **To provide you with a broad overview of various tree pests**
- **Signs and symptoms, diagnostic methods and tools**
- **Methods used to improve plant health.**
- **Identification of insects, diseases, environmental problems, nutrient problems, animal damages, natural problems and people pests**
- **Tree by Tree common problems**
- **Tree problem samples and pictures**

MY GOALS FOR YOU TODAY

- **Sometime during the next 3 hours, I want you to make at least a comment, an observation or ask a question.**
- **You can do this at anytime during the presentation.**
- **You learn more if you participate.**
- **If, in the third hour you haven't said anything, then I will begin to call on you to participate.**
- **I'm giving you the opportunity to pick the time and the topic first**

WHO AM I?

- **I AM NOT:**
- an ENTOMOLOGIST
- a PLANT PATHOLOGIST
- That means were ARE NOT going to look at boring life cycles of insects or diseases
- **I AM:**
- A tree observer for 40 years
- Self-employed and I go out each day doing diagnosis of and treating plant health care problems of all kinds.
- Someone who wants to improve health care diagnosis for everyone

MY BACK GROUND

- **B**oard-**C**ertified **M**aster **A**rborist (35TX, 3000CA)
- CA vs BCMA
- I get more calls from ISA website and West TX folks who don't have arborists.
- Landscape Horticulturist, TAMU, Floriculture(Woody Ornamentals)
- Managed Garden Centers, Landscape Contractor,
- Own HortiCare "Improving Plant Health" 20 years
- Total referral, work everyday, 8 jobs a day
- **I produce results using whatever methods are needed**
- I always follow-up
- Motto: "*It Just Takes An Acorn*"

THE REST OF THE STORY…..

- **C**ROSS **T**IMBERS **U**RBAN **F**ORESTRY **C**OUNCIL
- Tour Guide
- Tree Historian
- Token Hippie w/ David Coke
- **BOARD MEMBER OF THE FORT WORTH NATURE CENTER**
- **TARRANT COUNTY HISTORICAL COMMISSION**
- **AUTHOR** –The Trees of Our Lake, Diagnosis Tree and Shrub Problems in DFW, The Civilian Conservation Corps of Lake Worth
- **ARTIST**

THERE'S A LITTLE MORE.....

- **HISTORIC TREES (You have historic tree TTME!!!)**
- 22 Fort Worth Heritage Tree Designations
- 4 Famous Trees of Texas Designations

CHAMPION TREES

1 State Champion

5 Regional Champions

2 Reg. Co-champions

TREES ARE VERY IMPORTANT TO ME FOR MANY REASONS!!!!!! I produce reasons for protection!!

ONE MORE THING

- **I believe that my wide range of tree experience and years of observing trees makes me a better tree problem diagnostician.**
- **What else makes us better?**
- Education
- Observe. Observe, observe……then observe some more!
- Practice
- Follow-up
- Experience
- Site Analysis
- Learn common problems of specific trees

WES'S RULE OF MANAGING INSECTS AND DISEASES

- **If you can't tell an insect from a disease from an animal problem from an environmental problem from a people problem from a natural problem, then how in the heck can you manage insect and diseases? Answer: You can't**
- **I'm here to help you with that today**

PREFACE

This handbook was designed and written to help those interested in plant health care in the Dallas-Fort Worth metroplex area. By using this guide, you should be able to accurately diagnose most abiotic and biotic issues of trees and shrubs in the area. Since the list of pesticides and application methods that are available for our use is continually changing, no attempt was made to identify specific pesticides for use. However, specific identification of fungal, bacterial, or other causal organisms are made so you can determine the type of pesticide needed. In many cases, the type and method of pesticide application should be varied or changed at times to improve effectiveness and reduce pesticide resistance possibilities.

The determination and diagnosis of tree and shrub problems requires not

The determination and diagnosis of tree and shrub problems requires not only a diagnostic guide like this, but it also requires experience studying the flora of our area. What's normal and what's not for each of these plants? Sometimes diagnosis requires knowing the history of the property. Has something happened in the past that's causing the problem? Diagnosis sometimes has many facets. The more you learn about individual plants, plant systems, abiotic problems, soils, insects, diseases, and natural processes; the better the tree and shrub diagnostician that you'll be.

How to use this manual.

1. Use the list of signs and symptoms to narrow down the possibilities

So, we got a call, a customer has a problem, no idea what it is, few clues.

What do we need in our tool box to determine the source of the problem?

What if it's not an insect or disease?

THE DIAGNOSTIC TOOL BOX

HAVE TO HAVE

- Binoculars
- Hand lens/magnifying glass
- Pole Pruner
- Loppers
- Hand Pruner
- Hand Pick
- Long screwdriver/Ice pick
- Handbook
- Sharp knife
- Rubber hammer

MAY BE NEEDED

- Plastic specimen bags
- Cooler for diagnostic specimens
- Insect jar
- Stethoscope
- Defibrillation paddles
- Incense
- Eagle feathers
- Medicine man($75/hr.)
- The tree dance

THE DIAGNOSTIC MINDSET

No matter what you were told you about the tree problem:

KEEP AN OPEN MIND

DON'T HAVE PRECONCIEVED IDEAS

Take your time, circle the tree, observe, observe, observe

Concentrate on problem areas

Think like a tree. Ask for private time

GOAL: This tree may have multiple problems. What's the main issue?

- I’m doing a “Tree Staredown”

- Don’t blink first

WHAT IS A PEST?

PESTS CAN BE:

- Insects
- Mites
- Diseases
- Nematodes
- People who ask too many questions.
- Animals
- Rodents
- People
- Young kids
- Next door neighbors

Integrated Pest Management

- A systematic approach to insect and disease management.
- It incorporates a combination of techniques including:
- resistant plants, cultural practices,
- along with mechanical, biological and chemical
- controls of plant pest problems.
- The goal is to minimize the adverse ecological impact of intervention practices.

WHAT INTERVENTION PRACTICES/TOOL DO ARBORISTS USE TO SOLVE PEST PROBLEMS

- Fungicides(disease controls)
- Insecticides(insect controls)
- Soil Injection
- Trunk Microinjection
- Basal drenches
- Microbial pesticide extracts (Bt)
- **Application timing may be critical**
- Insecticidal soaps
- Horticultural oil
- Botanicals(hormones}
- Biologicals(predatory insects)
- Growth regulators
- Pruning/picking
- Air spades

FUNGICIDES AND INSECTICIDES

ABOUT THEM

- LIQUIDS
- POWDER
- CONCENTRATES
- GRANULES

- **CONTACT OR SYSTEMIC**

MORE ABOUT THEM

- Less odor, Less harmful
- Can be used in smaller amounts
- Systemics save beneficial insects, longer control
- Can inject right into a trees vascular system

ORGANIC PRODUCTS

AMENDMENTS

- Fish - fertilizer
- Seaweed – many, stress, roots
- Molasses – fertilizer, microorganisms(dried/liquid)
- Compost
- Gypsum
- Micronutrients iron, manganese, zinc, sulfur
- Vinegar
- Mychorrizal fungi

INSECT/ DISEASE CONTROLS

- Pyrethrins - chysanthemums
- Spinosad
- Bt – *Bacillus thuringiensis*
- Orange Oil
- Garlic
- Neem (Fung/ins/mite)
- Praying mantis
- Nematodes
- Trichogramma wasps
- Traps

- **“The Great French Marshall Lyantry once asked his gardener to plant a tree. The gardener objected that the tree was slow growing and would not reach maturity for 100 years. The Marshall replied, ‘In that case , there’s no time to lose, plant it today!’”**

What is an insect?

AN INSECT:

- Has six legs
- Has an exoskeleton, not an interior skeleton
- They are segmented into three basic body parts:
- Head……Thorax……Abdomen

What do

Insects do?

INSECTS:

- Cut
- Chew
- Bore
- Some spread diseases
- Disfigure, discolor, or damage leaves
- Skeletonize
- Devalue nursery stock

- Suck
- Stipple leaves
- Stunt
- Cause wounds
- Excrete honeydew
- Cause sooty mold
- Some cause galls

- Damaged leaves don’t heal. Examine new growth for results

What is a Disease?

A DISEASE IS:

- Any disturbance of a plant that interferes with its normal structure, function or economic value.
- Something that has a negative impact on the health and vigor of plants.
- Something that can cause an adverse effect on the plants appearance.

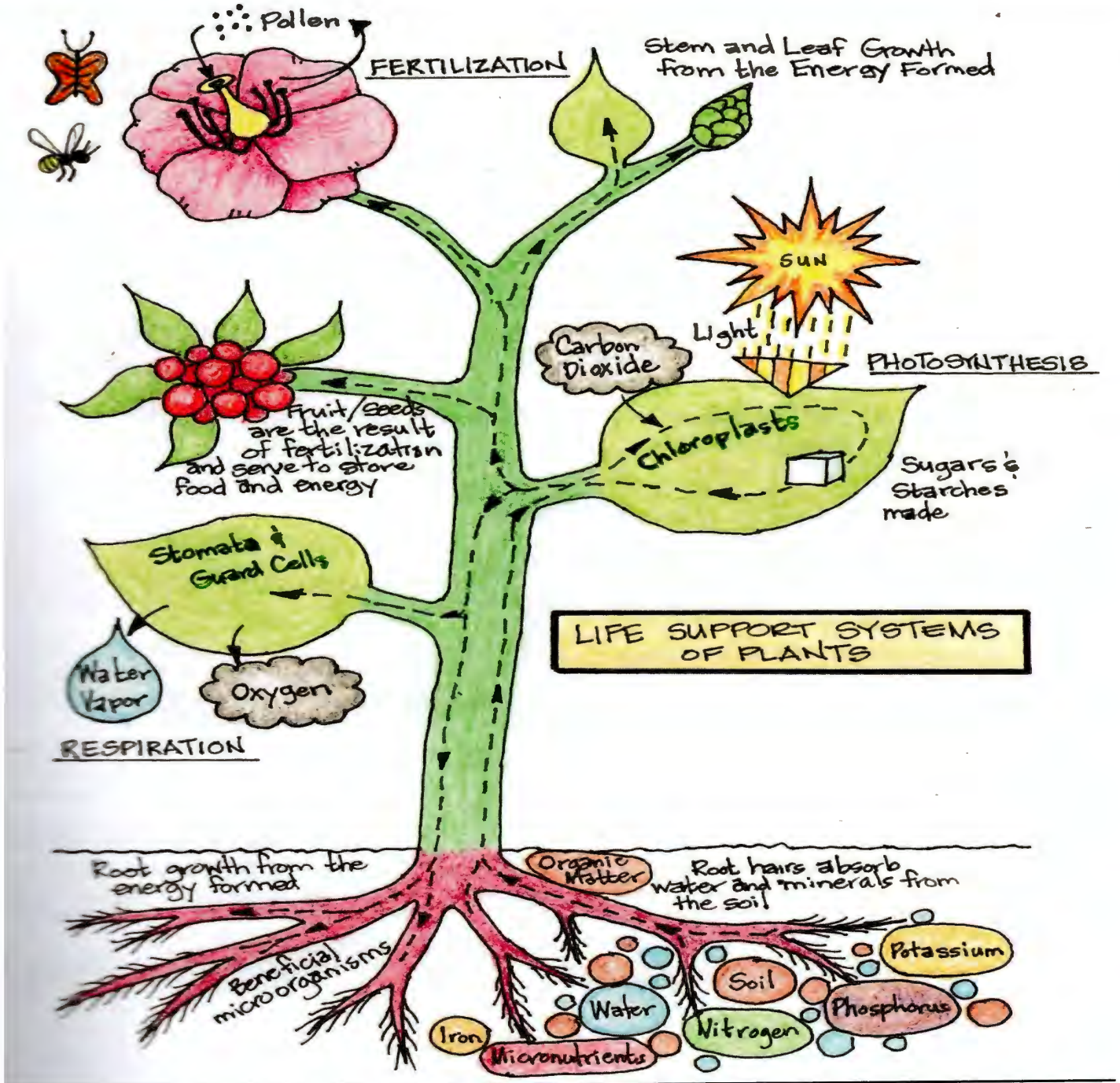
DISEASE CAUSING AGENTS

Biotic (Living)

- Caused by microorganisms called PATHOGENS
- Fungi
- Bacteria
- Viruses
- Nematodes

Abiotic (Nonliving, disorders)

- Environmental
- Nutritional Issues
- Toxicities (deicing salts)
- Pesticides
- People/Animals??


Pollen
FERTILIZATION
Stem and Leaf Growth from the Energy Formed
SUN
Light
PHOTOSYNTHESIS
Carbon Dioxide
Chloroplasts
Sugars & Starches made
Fruit/Seeds are the result of fertilization and serve to store food and energy
Stomata & Guard Cells
Water Vapor
Oxygen
RESPIRATION
LIFE SUPPORT SYSTEMS OF PLANTS
Root growth from the energy formed
Organic Matter
Root hairs absorb water and minerals from the soil
Beneficial microorganisms
Water
Soil
Potassium
Phosphorus
Nitrogen
Iron
Micronutrients

How do we tell the difference between insect and disease damage?

NON TECHNICAL IDEAS

- **Flower petal picking**
- **Flipping coins**
- **High card**
- **Decision dice**
- **Dart board**
- **Drawing lots**
- **None of these are recognized by ISA**

What else can cause plant health problems that may cause us to think we have an insect or disease problem?

ENVIRONMENTAL PROBLEMS

- **Flooding**
- **Heat**
- **Cold**
- **Wind**
- **Snow**
- **Drought**
- **Lightning**
- **Humidity**
- **Soil Compaction**
- **Hail**

PEOPLE PROBLEMS

- Over-mulching
- Planting too deep
- Mower damage
- Chemical spills
- Overfertilization
- Chemical abuse
- Desire for difficult species
- Planting / wrong place
- Overwatering
- Underwatering
- Weedeater damage
- Herbicides
- Bad pruning
- Bad staking monitoring
- IGNORANCE

ANIMAL PROBLEMS

- Armadillos
- Dogs
- Cats
- Deer
- Rabbits
- Horses
- Goats
- Beaver/Nutria
- Gophers
- Moles
- Voles
- Squirrels
- Birds
- Goatman/Snipe?

NUTRITIONAL DEFICIENCES

- The main nutrient deficiency problem in our area is Chlorosis. This is caused by our **limestone based alkaline soils**
- At high pH levels, micronutrients **get chemically tied to soil particles** and aren't available for plant use(like Smart phones)
- Iron, magnesium, manganese, sulfur
- The leaf turns **yellow with green veins** and looks very similar to oak wilt.
- Chlorotic leaves **lack chlorophyll and can't make food** and the leaves burn easily resembling heat **leaf scorch.**

•

- **WHAT PLANT HEALTHCARE TECHNIQUE SHOULD WE USE TO SOLVE THIS PROBLEM?**

LET’S TAKE 3- 5 MINUTES GET UP MOVE AROUND

Some serious stuff about to come up

THE NUMBER ONE THING WE USE TO DIAGNOSE PLANT PROBLEMS ARE:

Signs and symptoms

are our main clues.

Observation skills very important.

Kit Carson Police Flashlights

SYMPTOMS AND SIGNS
OF COMMON INSECT AND DISEASE PROBLEMS

*** Denotes a very common problem in D/FW area**

BALLED ROOTS Fig. P-1, 2, 5

Over grown in pot before planting
Planting hole walls are difficult for new roots to penetrate
Root kinking and choking off can cause flat side of tree
See girdling roots

BARK CRACKING Fig. E 13-19 Fig. P 6-8

Freeze damage
* Sun scald – Newly exposed bark, Fig. E-18, 18A, 19
Usually southwest side
Thin barked trees like Red Oak, Bradford Pear, and Maple
recommend – tree wrap
Lightning strike, Fig. E-6, 7

BUDS DIE OR DROP

Transplant shock
Cold or frost
Drought

CONKS AND MUSHROOMS Fig. D 1-6

Dead portions of trees, rotting wood, rotting roots, *Ganoderma, Armillaria*
Phytophtora diseases

FEW OR NO FLOWERS

Juvenility
* Improper pruning of flower buds, timing, or too much pruning
Nutrient imbalance, Fig. N-1-8
*Shade, too much

FLAKING BARK Fig. E 13-19, P 6-7

Natural like crepe myrtles, sycamores and lacebark elms – exfoliating bark, Fig. E-13
Natural in active growth crotch areas of bigger trees, Fig. E-14, 15
Included bark squeezed between two close growing stems, a weak connection, eg. Bradford pears, Fig. E-17
Bark removed by mowing equipment and tractors, Fig. P-6, 7
Vertical split, usually on the SW side of a young slick-barked tree, Eg. Red oak, sunscald, Fig. E-18, 18A, 19

LEAVES TURN LIGHT GREEN TO YELLOW Fig. N 1-4

Air pollution – usually black, purple or white specks; rough and dirty feeling
* Over watering / poor drainage
Nitrogen deficiency
*Iron deficiency – green veins with yellow leaf, Fig. N-2, 3, 4, 5, 7, 8
Magnesium deficiency –like iron deficiency, but green veins usually thicker or wider, Fig. N-1A, B, C

LEAVES THAT HAVE BEEN STRIPPED TO THE VEINS Fig. I 15-16

Skeltonizer, Fig. I-15

LEAVES ARE SPECKLED Fig. I 4-7

Like needle pricks
* Spider mites – webs
* Aphids – honeydew & sooty mold
* Lacebug – black dots under leaf
Air pollution
*Scale

LEAVES ARE SPOTTED

* Fungal leaf spot – usually bordered edged spots, avoid foliar irrigation, good sanitation, improve air flow, limit pruning
* Insects – such as leafminer with dead tissue patches or trails, scale
* Sunburn
Tar spot on Live Oak, *Rhytisma*
*White spots – mildew

LEAF SCORCH

* Extreme heat and wind, Fig. E-8A-D

Winter burn, Fig. E-27, 28

Bacterial leaf scorch – brown areas surrounded by thin yellow irregular shaped border, *Xylella fastidiosa,* Fig. D-11

Damaged roots

* Under watering, usually a fairly even scorch around the leaf edge

Oak Wilt (Red Oak) *Ceratosystis fagacerum,* Fig. D-16A-E

LEAVES HAVE STICKY SUBSTANCE (Honeydew) AND BLACK COVERING (Sooty Mold) Fig I 4-6, 8-12

* Aphids
* Mealybugs
* Soft Scale
* Whiteflies

*Crepe mrytle scale

LEAVES ARE STRIPPED TO THE MID VEIN

Cankerworm

LEAVES WITH WEBS Fig. I 13, 14

*Spider mites / Oak mites
*Caterpillars
*Webworms, tent caterpillars, Fig. I-13, 14

LICHEN Fig. E-4,5

Usually north side of tree, symbiotic (no harm) relationship

MISTLETOE

Saps the life's blood from tree limbs and also causes greatly distorted and weakened growth

Appl Florel spray during dormant season, prune out mistletoe to remove feeding tube(small dot off-center in limb cross section), coat with dark pruning paint to prevent photosynthesis

NO ROOT FLARE VISIBLE Fig. P-5

Planted too deep, Fig. P-5
Mulch too deep, Fig. P-14
Drop leaves early
Bud out late
Slower, stunted growth
Possible root collar rot
Short lived

NON PATHOGENIC DAMAGES Fig. E 6-7

Lightning, Fig. E-6, 7
Freeze, Fig. E-27, 28
Flooding
Girdling, Fig. P-1, 3, 3A, 3B, 12, 13
Drought
Mower, Weed eater, automobile
Wind
Soil Compaction
Trenching
Soil grading or fill

OOZING SAP Fig. D-3, E-8

Natural tendency
Environmental stress – especially heat, Fig. E-19
Mechanical injury
Disease – Slime flux, Elms, Bacteria; Bleeding cankers, Oak, fungus, Fig. D-7A, 7B
Borers or bark beetles, Fig. I-1, 2A, 2B
Pine pressure in spring
Excessive rain
Pruning in the spring

ROOTS AT SURFACE Fig. P-3, E 20

* Dry soil
Waterlogged soil
Natural tendency – Magnolia, Bald Cypress, Cottonwood
Compacted soil
Confined roots – patio pot, planter box, parking lot, etc., Fig. P-1, 2, 3A, 3B
Planting strips
Erosion
Flooding can cause adventitious roots to grow on the lower trunk and exposed roots, eg. Willow, Fig.E-20

SAWDUST BELOW TREE / SHRUB Fig. I 1-3

Carpenter ants, dead wood, termites, wood cutter bees, Fig. I-4

SMALL TRUNKS CUT DOWN Fig. E 9-10

Beaver, Nutria

TRUNKS STRIPPED OF BARK Fig. E 9-10, P 6-7

Nutria, Beaver, Deer, Cattle, Horses, Goats

TWIG OR BRANCH DIEBACK

Mechanical injury, Fig.P-14
Cankers
Borers
Fungal blight – usually kills twigs irregularly, Juniper *Phomopsis*
Root rot
Vascular disease – *Verticillium / Fusarium,* Oak Wilt, Fig. D-16A-E

WHITE SPORE MATS FORMING ON SOIL SURFACE

Texas Cotton root rot, *Phymatotricum omnivorum*, (fungus) the most destructive plant disease in Texas, attacks more than 2000 plant species – more than any other known pathogen, spore mats form July to frost, but are not always produced.

WHITE, COTTONY MASSES ON PLANT Fig. I 8-10

* Mealybugs
* Cottony-cushion scale
*Crepe myrtle scale, mainly on the stems, Fig. I-8, 9, 10

NOTES: _____

_____

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Frank Lloyd Wright

- **“The best friend on Earth of man is the tree. When we use the tree respectfully and economically, we have one of the greatest resources on the earth.”**

INSECTS

INSECT TRIANGLE

THE HOST PLANT

Houston, We have a problem!

RIGHT CONDITIONS **THE INSECT**

Beneficial Insects

LADY BEETLE LARVAE

MORE BENEFICIALS

- Lady Beetles are sweet and cute, but they are cannibalistic
- Flower flies – lay predatory eggs
- Damsel Bugs – eat aphids and mites in all stages
- Mirid bug – can eat 20 lacebugs a day
- Predatory mites – eat spider mites
- Lacewings – one larvae may eat sev. 100 S. Mites in 2 weeks
- Predatory gall midges – mosquito-like, some attack plants
- Stink bugs – predator of more than 100 insect pest species
- Parasitic wasps – armored scale, webworms

HARMFUL INSECTS

APHIDS

- 1/8-1/4 inch, mainly green, pear shaped, probably the most prolific of insects, suck plant nutrient sap and poop it out on the plant as a sticky honey dew, can cause distorted leaf growth, spread diseases, possibly viruses, a black sooty mold grows on the honeydew, no problem except blocking photosynthesis, enemies: green lacewing, lady beetle, use systemics for long lasting control and not harm the beneficial insects. NO SPRAYING!
- Have a “special” arrangement with ants!

BAGWORMS

- 1-2 inches long, worm encased in covering with dried plant materials, they attack many plants, esp. Junipers, etc., strip foliage from the trees, girdle twigs, can kill an evergreen in one season, one generation per season, eggs overwinter in remaining bags, hand-picking is very effective.
- WARNING: This problem needs to be dealt with quickly, evergreen recovery is very slow.

BORERS

- Worms ½ -1 inch, usually light colored, most common, in soft wooded tree, tunnel through the trunk cutting off nutrient and water supply, normally on the lower 15’ of the tree, the are the vultures of the insect world. There job is to destroy deadwood. In our oaks and other hardwood trees, borers are usually limited to deadwood unless the tree is in extreme distress. Systemic insect control required

MORE BORERS

GALLS
CYNIPID WASPS

Gall insects an cause galls on many types of trees. Usually small wasps sting leaves or twigs then lay eggs and then the plant responds by developing tissue around the affected area. These galls can look like small warts, fuzzy balls, wooden marbles, horned galls or papery golf balls.

Galls are seldom harmful. Galls are mainly an aesthetic issue. There is no organic or chemical control.

GRASSHOPPERS

- All tender growth is susceptible and they can strip foliage totally. Populations cycle. NOLO Bait causes a disease in grasshoppers and can sometimes aid in control for several years.

LACEBUGS

- 1/8-14” black, attack sycamores, bur oaks and attack elms, esp. American elms. Suck plant sap from leaves giving them a tan to golden color. Speckled. Black, waxy, semi-vertical specks on the bottom of leaves. Produce honey dew and sooty mold. Black stained trees are visible during the dormant season. Systemic insect control basally applied in May.

MORE LACEBUG

- **This Sycamore is a direct descendant of the tree Adam and Eve used for clothing in the Garden of Eden.**

LEAFCUTTER ANTS/BEES

LEAFMINERS

- 1/16 inch, larvae tunnel though the top and lower surfaces of leaves, leaving dead “trails” in the leaves. This is a “serpentine LM” and there is also a “blotchLM”. Common in live oaks. Usually not worth treating. Systemics needed if control desired.

MEALYBUGS

- 1/8-1/4 inch, creamy white, suck plant sap, secrete honeydew, very messy appearance, a high pressure water hose can eliminate much of your problem

NEMATODES

- Not an insect, a soft-bodied tubular, microscopic worm found in some soils. Some species attack plants such as the root knot nematode. Beneficial species attack fleas, grubs and fire ants. Trying to disperse and get beneficial nematodes started in TX is very difficult

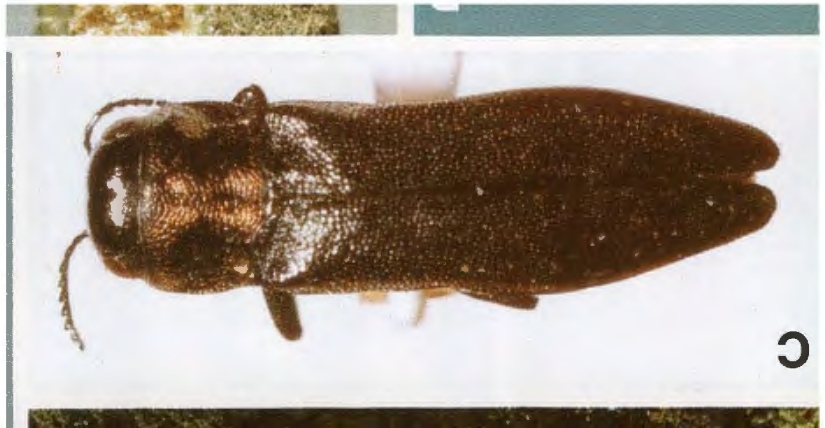
SCALE

- Shown is Lecanium scale.
- Hard & SoftScales
- 1/16-1/4 inch, many kinds, many trees
- Suck sap and can kill large portions of a pant
- When controlled, **they remain on the plant**.
- Spraying is not effective,
- Systemics are required.
- Hort. Dormant Oil??

MORE SCALE

TWIG GIRDLERS VS SQUIRRELS

The bronze oak twig girdling beetle makes a clean cut around the twig like a saw cut. Eggs are laid in the twig being removed. Clean up of the twigs is our main control. Squirrel cuts are very jagged and at about a 45 degree angle



WEBWORMS
TENT CATERPILLARS

- 1-1 ½ inches long
- They create unsightly webs and strip the leaves.
- They attack many tree types
- Rarely very damaging
- Have multiple generations depending on rain and humidity.
- Chemical control is possible, but it’s best to break open the web with a pole, or a rock or a football.
- Small wasps will take care of them then

20/40 RULE FOR TREATING TREE DEFOLIATORS

- **Trees can tolerate:**
- **20 % defoliation in the spring**
- **40% defoliation in the summer**

- **Without reducing a lot of their stored energy**

GYPSY MOTH

- Gypsy moth totally defoliates forests in New England about every 4-5 years.
- TOTAL
- You can’t see the horizon in N. Eng. for all the trees.
- These insects cause traffic wrecks

- **5-10 MINUTE BREAK**

MITES

MITES VS. INSECTS

MITES

- 8 legs
- Most microscopic
- Many species
- Mainly sucking organisms
- Attack plants, animals and man
- Few controls, sulfur
- Ex. Chigger
- Spread diseases, Rose Rosette Virus

INSECTS

- Six legs
- Most visible with the eye or hand lens
- Many species
- Many methods of attack
- Many controls available
- Some spread diseases. Ex Oak Wilt

SPIDER MITES

- I have nominated this bad bug for the official STATE MITE, it's everywhere! Loves hot Texas summers and water-stressed plants. This mite will take a couple of shots of plant sap and walk out the swinging saloon doors leaving only stippled, dry and brown leaves in a fine webbing as tips for the dancing girls.

STUNT MITES

- **Stunt mites inject a poison into apical tree leaves which can cause stunting and “rosetting”.**

- **Sorry no pics**
- **Bur oaks**

Jacquelyn Hiller

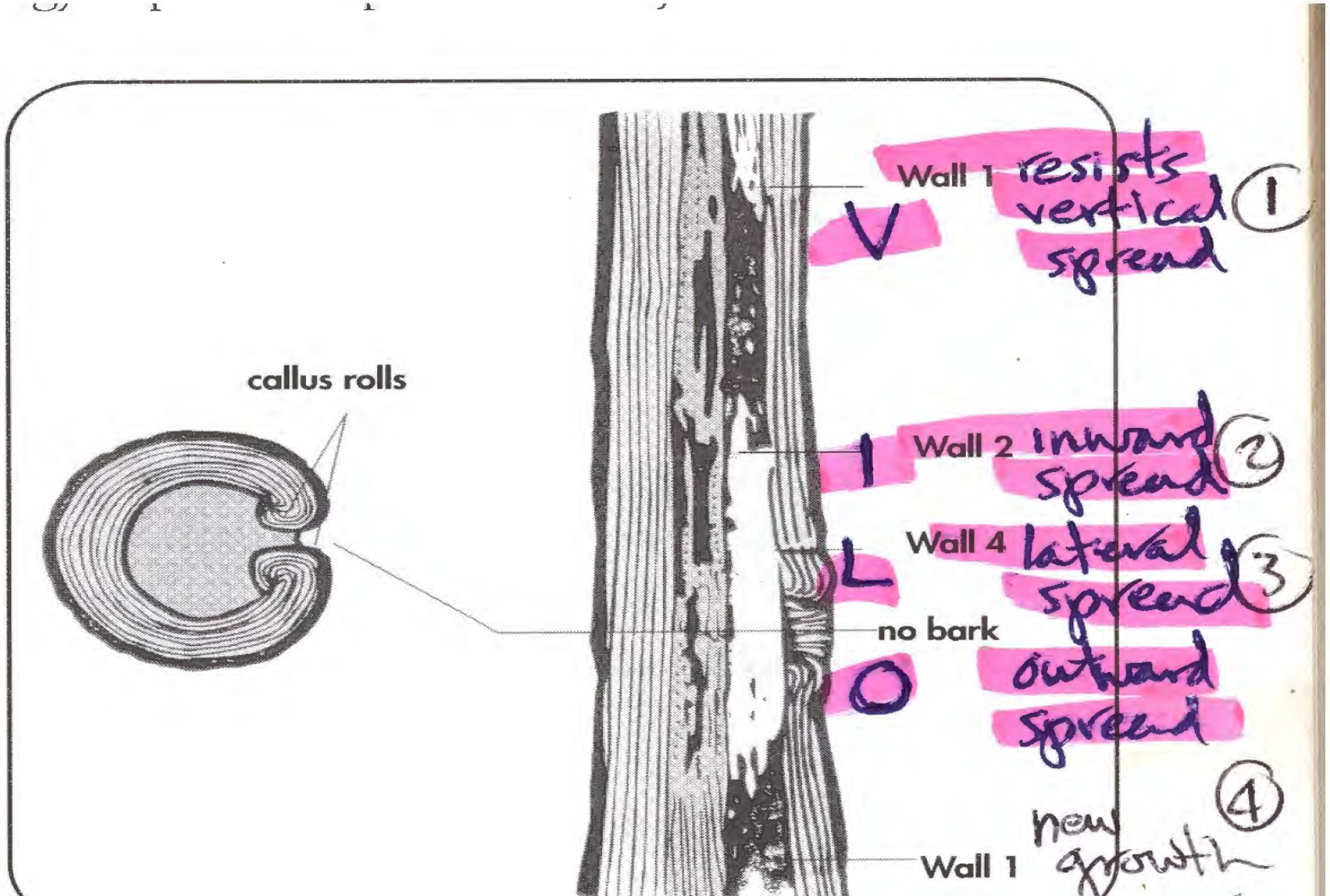
- **“There once was a handsome mockingbird that sang his heart out every morning during nesting season from the top of a tall oak tree. Last week the tree was cut down. The mockingbird and his song are gone. I can’t put a dollar value on the mockingbird or his song. But, I know that I and our whole neighborhood have suffered a loss. I wouldn’t know how to count it in dollars.”**

DISEASES

DISEASE TRIANGLE

- **THE HOST PLANT**
- **Ding dong, the Wicked Witch is here**
- **RIGHT CONDITIONS** **PATHOGEN**

CODIT


callus rolls
Wall 1
resists vertical spread
1
V
Wall 2
inward spread
2
I
Wall 4
lateral spread
3
L
no bark
outward spread
O
4
new growth
Wall 1

BACTERIAL CROWN GALL

- Relatively infrequent and unimportant problem.
- Attacks more species of trees than any other bacterial pathogen

BACTERIAL LEAF SCORCH

- Fatal, but it takes a while
- Sycamores, red oaks, American elms, live oaks.
- Leafhoppers are the main vector.
- Causing browning and scorching and leaves.
- Same as Pierces' Disease in grapes
- Trunk microinjections of antibiotics about Apr/May help to lessen the symptoms.

BUTT ROT

- This is Ganoderma, one of the most recognizable and deadly of the butt/root rot fungi
- This fungi will attack both live and dead wood..
- Most decay fungi decompose wood that is already dead.
- Some people let these dry and do carvings on the backside.

BUTT ROT

Armillaria

CANKER

- A stress related disease that causes the decay of the bark and inner wood.
- Can appear as cracks, sunken areas, or even raised areas of dead tissue or abnormal tissue.
- Some cankers ooze.
- Squirrels can inhibit healing

CANKER Nectria

POWDERY MILDEW

- White fungal growth over the top and bottom of leaves.
- Leaves become puckered and distorted. Just say it “Butt Ugly” Maybe nothing more so.
- Occurs in cool, humid and cloudy conditions.
- Nothing can change this back to normal. Must grow out of it.
- Chemical control can be effective as a preventative.

DOWNEY MILDEW

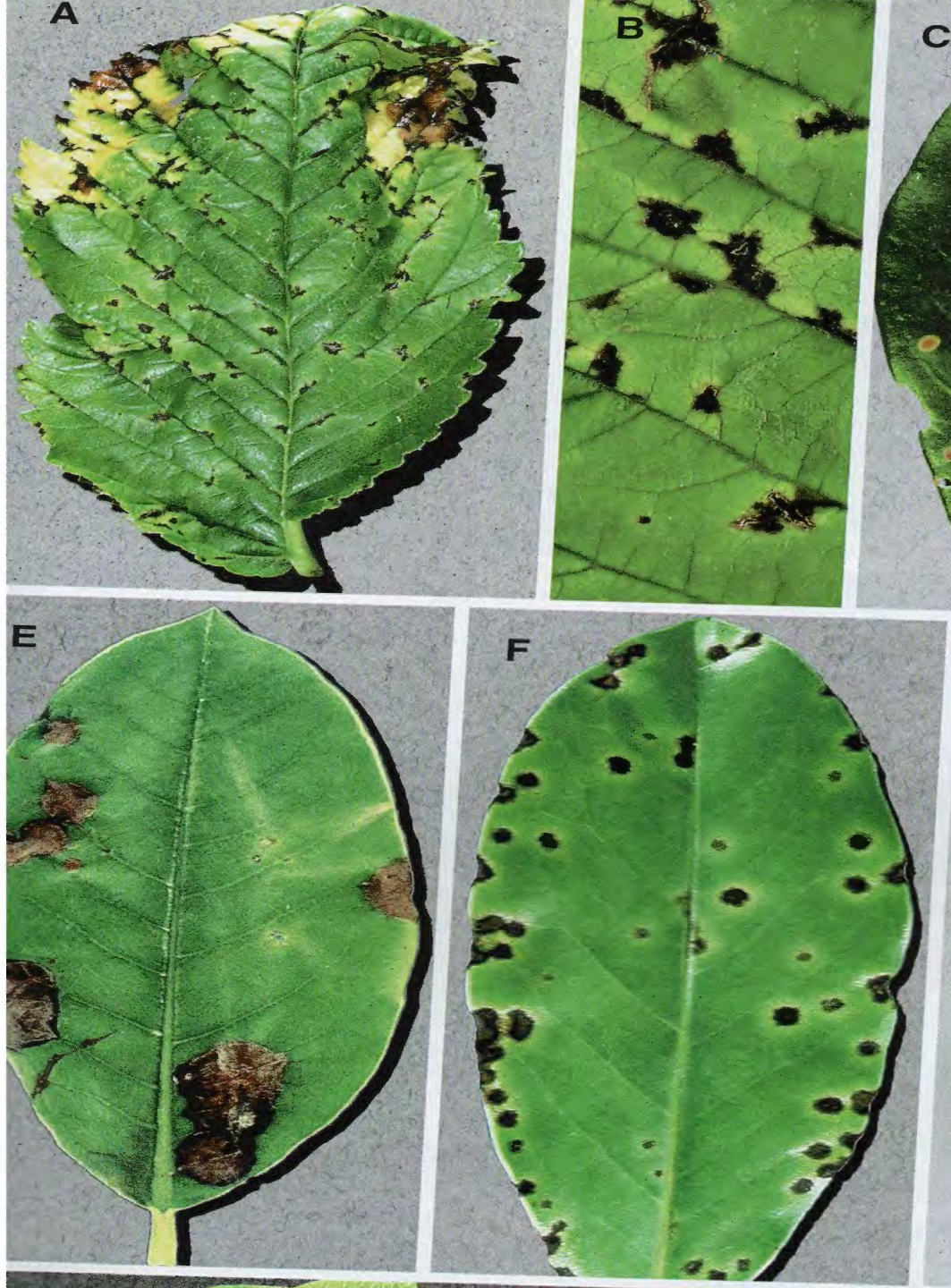
- Light green or off color spots appear on the upper surface of infected plant leaves,
- These lesions will turn red to brown.
- Leaf distortion can occur.
- Necrosis and early defoliation.
- Requires moist conditions.
- Better spacing and air flow usually keeps the problem controlled

FIRE BLIGHT

- Bacterial disease of the Rosacea Family: pears. Loquat, pyracantha.
- Twigs and entire limbs die back suddenly as if they were scorched with fire.
- Black leaves generally remain attached.
- Downward oozing spreads the disease, rain, humidity
- Pruning out of infected twigs and limbs. Antibiotics used as a preventative.

FUNGAL LEAF SPOTS

- Some are difficult to control. May requiring spraying at bud break in the spring.
- Many species.
- Usually border edged spots.
- Avoid foliar irrigation,
- Good sanitation.
- Improve air flow.
- Limit pruning/sanitize pruners



LEAF BLISTER

- A fairly rare disease of oaks.
- Results from heavy rainy season.
- Deforms leaves, blisters.
- Controls are unneeded and not effective.
- Kin to Peach Leaf Curl

MUSHROOMS AND CONKS

- Bottom line: these indicate dead and rotting wood and roots.
- In New England there is an orange colored conk that is harvested, and pickled. Very spicy!

MUSHROOMS can indicate root rot of live or removed trees

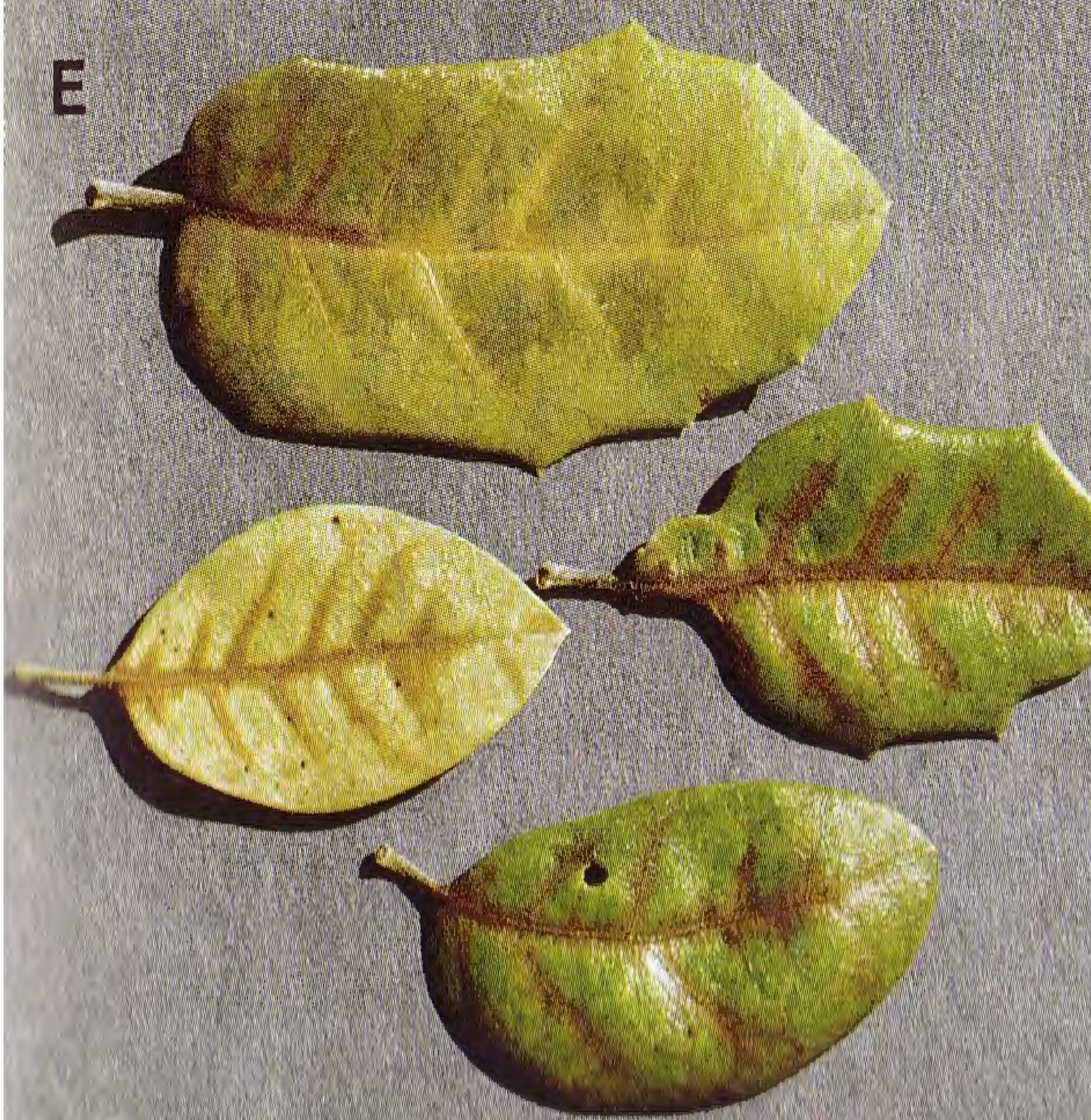
This is not good. Possible tree failure at any time

Theodore Roosevelt, 1907 Arbor Day proclamation

- **“ To exist as a nation, to prosper as a state and to live as a people, we must have trees!”**

OAK WILT

- A lethal vascular clogging disease that spreads through root grafts and by insects on new wounds. Chlorotic symptoms in live oaks, death in usually 6 months.
- Quick wilting and death in Red Oaks. No signs.
- Dead red oaks can have fungal patches under dead bark for beetles to feed on and spread the disease.
- Preventative injections can provide 3-5 yrs. protection



WHY ARE PEOPLE SO STUPID ABOUT TREES?

- **Dutch Elm Disease**
- **Chestnut Blight**
- **Emerald Ash Borer**
- **Oak Wilt**
- **We make many bad decisions based choosing aesthetics over tree care and health needs DIVERSITY!!!!!!**

VIRUSES

- Viruses are the smallest plant pathogens and can only be seen with an electron microscope.
- They replicate inside plant cells. Symptoms can be striking and vary. (Rose Rosette virus)
- Trees usually don’t die, but show decline.
- Viruses are spread by mites, nematodes, pollen and other sucking/piercing insects.
- There is no cure for viruses.

SLIME FLUX “WetWood”

- Bacterial disease that causes the heartwood to hold more water. Not in the cambium.
- Probably about 70% of American elms in T. County have this problem.
- Not as much a health problem as a lumber industry problem.
- Knots and cracks can release a foul smelling liquid.
- Driving plumbing pipes into the heartwood for drainage was once preferred.

ANIMALS

SAPSUCKER

- Bird, not an insect. Drills holes side by side in horizontal rows.
- Attacks trees who are stressed and producing excess sugars and sap in the cam

BEAVER/ NUTRIA

- If you live on the edge of a lake or a water-filled creek, then a beaver or a nutria can kill your tree,
- Physical protection is required.
- SIDE NOTE: Beavers make great cowboy hats and coats! Always wanted Beaver house shoes!!
- Oh baby, baby

SQUIRRELS

-
- **5-10 MINUTE BREAK**

ENVIRONMENT

MISTLETOE

- Some folks say that mistletoe doesn't hurt a tree. I say all that cheap talk means doodley squat!
- That mistletoe is sucking water and nutrients from that tree like a new born calf.
- Tree dies – mistletoe dies
- Distorts limbs causing breakage
- Pruning in the dormant season.
- Remove the HAUSTORIA!!!!!! (feeding tube)

SUNSCALD

- Caused by the sun, usually on the SW side of the tree trunk, of slick barked trees.
- Slick bark gets hotter than furrowed bark.
- One of the worst wounds a tree can endure!!!!! Long healing time.
- This wound attracts borer, wood ants, termites, wood rot fugus and more.
- Can be prevented with a breathable tree trunk wrap from June to Sept.
- Southlake in circles?

Chinese Proverb

- **“No shade tree, blame not the sun, but yourself”**

DROUGHT STRESS

- Texas trees need irrigation
- New trees, maybe 7 gallon/week/inch DBH
- *80% of the trees that die during the first 3 years is due to lack of water.
- B&B trees lose 80-90% of their roots when their dug
- Bucket trees, planted in peat moss, repel water when the soil ball gets dry.
- Test/observe drippers. ETC. during the summer on new trees.

BEWARE OF NEWLY PLANTED TREES

- The tree may have been planted too deep.
- May have damaged the trunk and the vascular system with a chain wrap to move it.
- A lot of water needed, but the hole may not drain
- The root ball may have been broken
- The foliage may be desiccated and shredded during delivery.
- Critical wires, straps, twine may not have been removed after planting causing future girdling issues
- Tree may not have been watered in, only boot-kickin’ dirt in the hole. Trees like water!!!
- About 80% of trees planted by professionals (guys with truck and shovels) are done incorrectly!!

LIGHTNING STRIKE

- Probably 70% don’t know their tree was hit,
- Usually the tallest trees
- There will be a split from top to bottom.
- Bark can be blown off,
- Damage is usually worse in the root zone area
- Iron & Manganese can be tied up.
- Unpredictable, but that tree won’t be hit again will it?

FREEZE DAMAGE

- Dry plants experience freeze damage worse.
- Palms, Italian Cypress – can cause long term damage
- Live Oaks – usually minor leaf edge burn, freeze blew the bark off old trees in the early 1980's.
- Fruit and Nut trees – timing can devastate crops
- Plant Hardiness Zones freeze not heat

PEOPLE

TREE STAKING

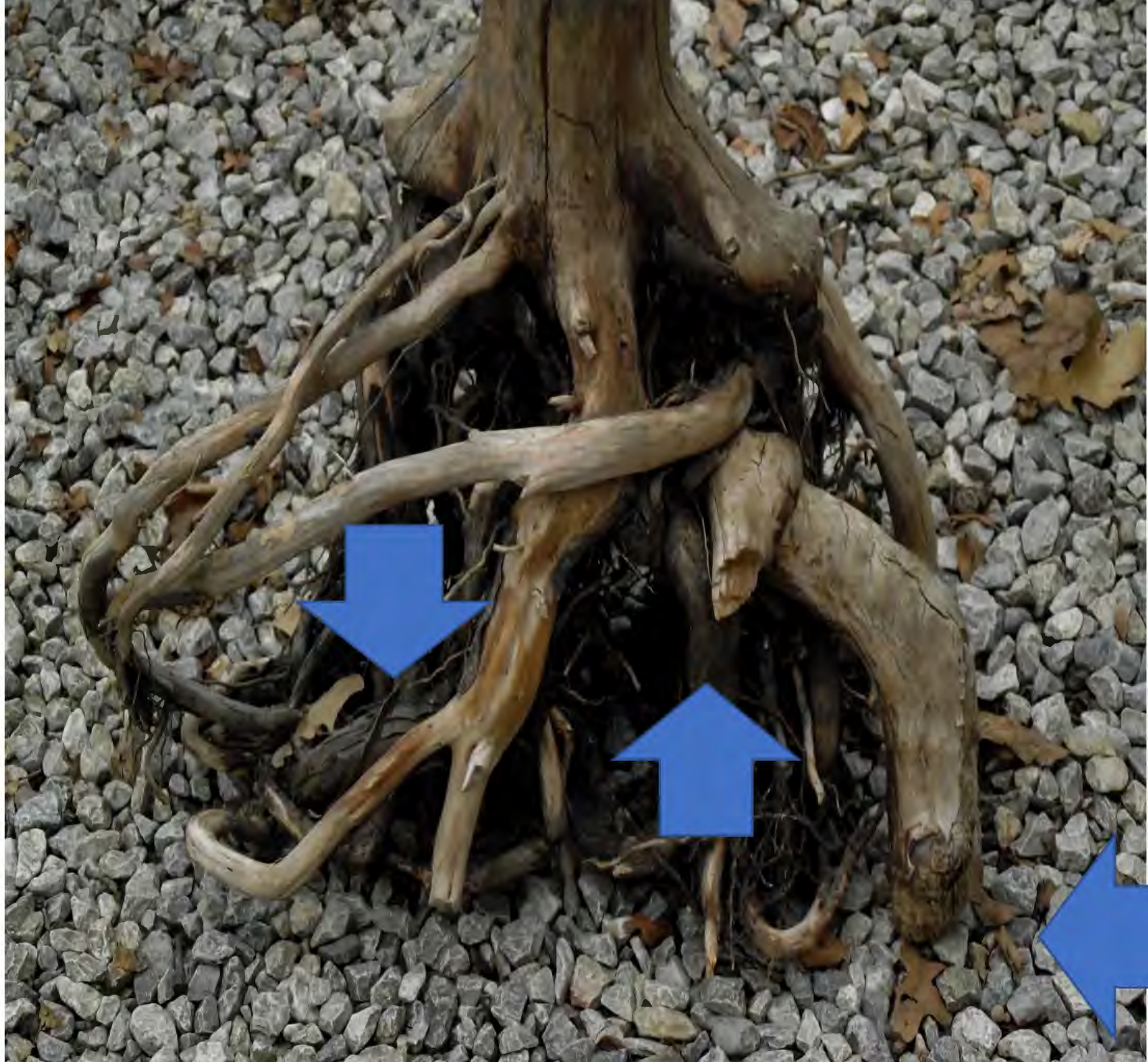
OVERMULCHING

- **Why are we trying to kill trees as fast as we plant them?**
- I know Governor Abbott doesn't care about trees, but is there someone who can stop this plot by Hispanic workers to kill Texas trees?
- Where is our educated arborist supervision? Don't they care!?!?!
- Instead of Arborists stopping this terrible thing, let's let Congress decide!!
- PS Trees produce Oxygen and we need that!!

GIRDLING ROOTS

BALLED ROOTS

- This is what the roots look like for the very large plant in a pot you just bought for a great deal
- OR
- This Bald Cypress was dug especially for you after you hand-picked it at the tree farm.
- 7-5 odds they planted it too deep too!



EXCAVATION DAMAGE

- This large vertical crack was caused by the addition of a new septic tank
- Post oaks have sensitive roots and lucky it didn’t die.
- It’s now a time capsule. Whoever removes this tree will find a lot of goodies.
- I’m glad it lived, it sprouted about the time that Paul Revere made his famous ride warning us of the British.

MOWER DAMAGE

WEEDEATER

- As we destroy the vascular system of this wonderful tree our goal is to leave no grass blades standing and absolutely no evidence of trying to improve the trees health.
- I GOT IT Pile 18 inches of mulch on top so we don’t have to weed-eat any more.
- Why do we hate plants and try to kill them?

VANDALISM

- This post oak was vandalized by a teenager with a hatchet in the mid 1980's. He stole all my fishing rods and invested the money. Now he's rich, I'm poor, and he is one of my best customers.

- SOME LOW-LIFE SCUM BAG TIED A DOG ON A CHAIN TO THIS TREE

HEALING WOUNDS

TREE USED AS A FENCE POST

- As with improper tree staking, trees can usually overcome human girdling if it's slow

Ralph Waldo Emerson

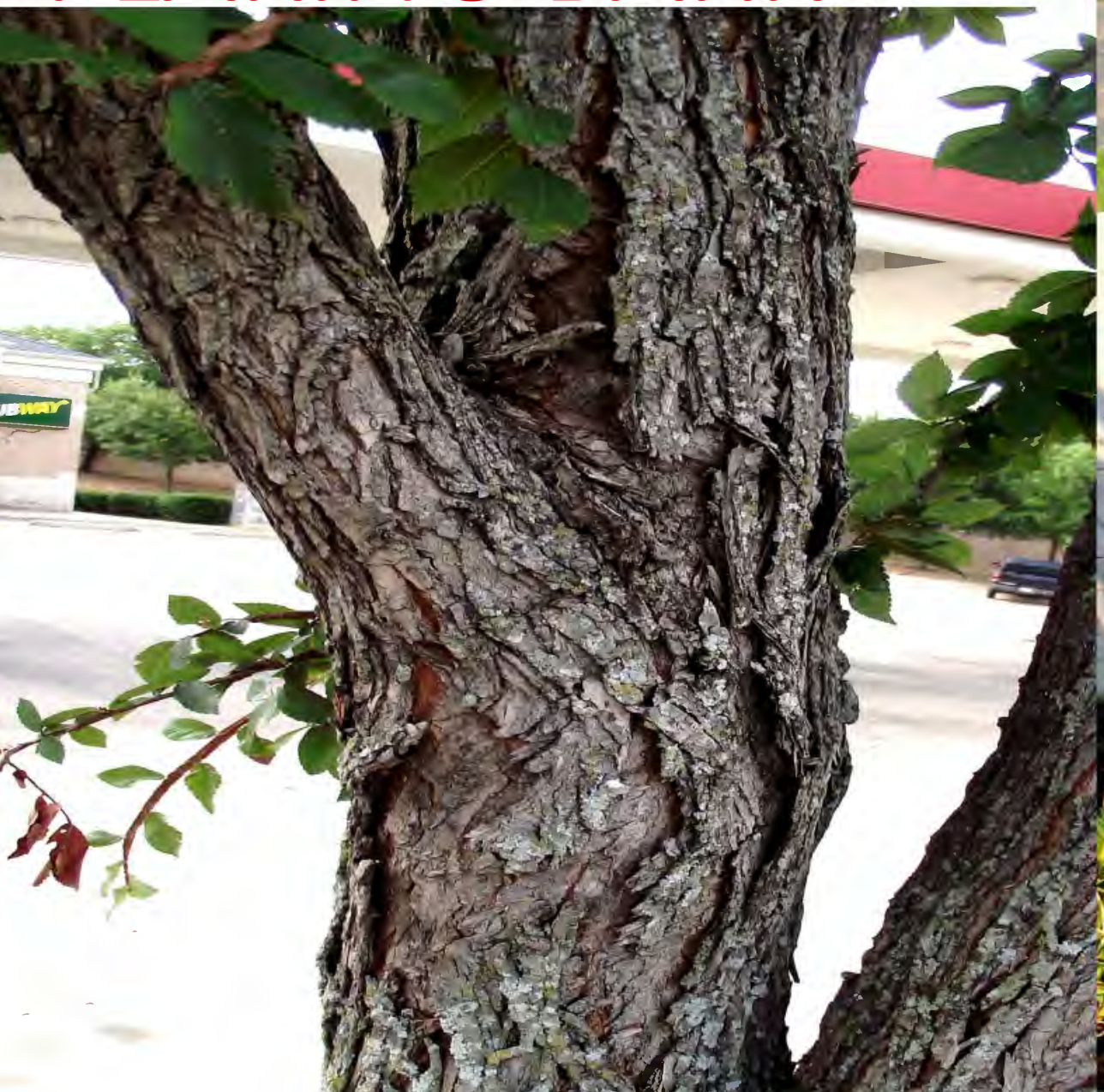
- **“ The creation of a thousand forests is in one acorn!”**

NATURAL

INCLUDED BARK

- More of a hazard analysis issue.
- Bark that becomes enclosed inside the crotch as the two branches grow and develop.
- This weakens the branch attachment.
- This attachment is more prone to failure.
- U joints rock, V joints suck!

FLAKING BARK



LICHENS

- Lichens live in a symbiotic relationship with the tree.
- Normally on the northside
- They don’t hurt each other.
- The lichen benefit more than the trees if at all.
- A fellow Nature Center Board member and BRIT scientists has identified more than 170 species of lichens at the FWNC&R
- Who care’s, my beer bottle collection is much bigger and better.!!!

NUTRIENT PROBLEMS

- **CHLOROSIS**
- **CHLOROSIS**
- **CHLOROSIS**
- **Our alkaline soils chemically tie up micronutrients that are in our soils.**
- **Resembles Oak Wilt**
- **Lack of chlorophyll, food production and leaf burning**

MORE CHLOROSIS

TREE BY TREE PROBLEMS

TREE PROBLEMS
BIOTIC AND ABIOTIC

*** Denotes a very common problem in D/FW area**

Environmental need for normal growth and special plant characteristics

ARIZONA CYPRESS

Blue green, trunks colorful with copper colored mottling, native to Big Bend area

- No serious pest problems
- Stands heat and drought quite well

ASH

Full sun, well-drained soil, fast growing, stay away from house and septic system, some take a lot of water, Green/Arizona/Texas ash

- Anthracnose (fungus) – main vein and surrounding tissue necrosis, brown dots treat in February – *Gloeosporium,* Fig. D-12
- Aphids – distorts leaves, soot mold, honeydew
- Borer – bark holes / trails, many kinds
- Canker (fungus) – sunken, dark, lesion on bark, a sore
- Heat stress, leaf dropping
- *Leaf scorch – leaf edge burning, wilting
- Yellow leaf spot – *Mycosphaerella*

BALD CYPRESS / POND CYPRESS

Grows native in southern swamps, natural swelling "knees" at base of trunk, deciduous

- Bagworms, Fig. I-18
- *Surface roots – natural tendency
- Twig blight (fungus) – sooty pustules on leaves, bark, and cones
- Mites – browning of needles during hot weather
- *Iron Chlorosis – needle yellowing

BIRCH

Peeling bark, not many, prefers moist soils

- *Iron Chlorosis, heat stress; leaf scorch
- *Alkaline, clay soils are a problem

BRADFORD PEAR

Full sun, deciduous, well drained soil, spring flowering white, weak limb attachments

- Bacterial fire blight – burnt, black look; usually starting at the top and moving down, oozing cankers on twigs-branches – *Erwinia amylovora,* Fig. D-13
- Bacterial leaf scorch – burnt leaf edges with yellow border,
- Fig. D-11
- *Sunscald – cracked bark, burnt leaf edges, cracked bark

CATALPA

Rich, moist soil, full sun, large heart-shaped leaves, long beans, beautiful flowers

- Catalpa sphinx caterpillar – May to August, large yellow and black striped caterpillars with sharp horn on tail end
- *Summer leaf scorch – burnt leaf edges and tissue
- *Verticillium* wilt – leaves turn yellow at edges first then brown; peel bark on dead parts reveals dark streaks, main killer of Catalpa in conjunction with heat stress

CHINABERRY

Full sun, weak wood, messy berries, pink blooms

- *Cotton root rot (fungus)

CHINESE PISTACHE

Full sun, deciduous, handles high heat

- Thread blight (fungus) – premature defoliation, dead leaves hang on tree matted together

CRABAPPLE

Sun, deciduous, most soils; spring flowering – rose-red, pink, white; fruit red or yellow

- Borers
- Fire Blight, Fig. D-13
- P. Mildew, Fig. D-14A, B
- Cotton root rot
- Rust
- Fungal leaf spots

COTTONWOOD

Full sun, deciduous, moist but well drained soil, seen in creek bottoms, weak wooded

- Leaf beetles – leaves lacy appearance, ¼" yellow beetle, yellow egg cluster on leaves
- Leaf feeding caterpillars – lacy appearance of remaining leaf, possible webs
- *Locust Borers – holes in bark, Fig. I-3
- Female plant – messy cotton
- *Slime flux / Wetwood (bacteria) – smelly sap oozing from wounds, cracks and branch crotches, Fig. D-7
- *Surface roots – need deep watering, deep soil
- Cotton root rot
- Serious leaf drop in hot summers

DEODAR CEDAR

Pyramidal, blue-green evergreen, Christmas tree like, native to Asia

- Iron Chlorosis
- Bagworms, Fig. I-18
- Cotton root rot
- Freeze damage to Waco, Fig. E-27

DOGWOOD

*Shade, well drained, not dry too long

- Iron Chlorosis, Fig. N-2, 3
- Leaf spot

ELM

Full sun, deciduous, seasonal poor drainage OK, leaf out early in spring and turn yellow and fall early in fall, American/Cedar/Lacebark or Chinese

- Dutch elm disease (fungus) – American elms, leaves wilt, curl and turn yellow, spread by bark beetles, #1 killer of elms – *Cerotocystis ulmi*
- Elm black spot (fungus) – minute black dots on leaf surface, #2 killer of elms – *Gnomonia ulmea*
- *Elm leaf beetles – chews lower surface of leaf, lacy, only small holes
- *Mistletoe – virtually impossible to eliminate, prune out when first found, Fig. E-25, 26
- Scale – leaves, branches, twigs covered with cottony, cushion-like masses
- Twig girdler – Cuts off small twigs up to 3/8 inch, Beaver point type cut, Fig. I-19
- Squirrel damage – will cover the ground with small twigs, jagged, angled cut, Fig. E-11, 12
- Bacterial leaf scorch – Fig. D-11
- *Slime flux – wetwood, bacteria, oozing stinky sap usually in tree crotch – *Erwinia nimipressuralis,* Fig.D-7A, B
- Wooly aphids – leaves with white cottony masses

GINKO

Deciduous, fan shaped leaf, yellow fall foliage, slow growing, can tolerate some drought, one of the oldest trees on earth, medicinal herb to improve mental function

- Anthracnose (fungus) – large blotches of tissue necrosis
- Pollution
- Restricted root growth area is a problem

GOLDENRAIN TREE

Full sun, yellow flowers in summer, fast growing, Japanese lantern-like seed pods

- Boxelder bugs – Fall, Fig. I-21

ITALIAN CYPRESS

Completely upright and columnar evergreen

- Spider Mites
- *Freeze damage, Fig. E-27
- *Bagworms, Fig. I-18

HACKBERRY

Full sun, deciduous, well drained soil

- *Leaf gall psyllids – galls under leaf, insect inside, not considered destructive
- *Mistletoe – virtually impossible to eliminate, must prune out immediately when first found, Fig. E-25, 26

LOQUAT

Small evergreen tree with large tropical-looking leaves, blooms late fall to early winter, flowers not showy, but fragrant, possible edible fruit in southern areas

- Fire blight, Fig. D-13
- Cotton root rot
- *Freeze damage, Fig. E-27

MAGNOLIA

Part-shade, full sun, evergreen/deciduous, moist well drained soil, spring flowering, southern-white, saucer-white, orchid blend, Southern/Little Gem/Star

- Iron deficiency – green veins, yellow leaves
- Leaf drop, normal in spring, late summer due to heat
- Leaf scorch – burnt leaf edges, Fig. 8-C
- *Surface roots – needs deep watering, deep soil
- Difficult to grow anything under this tree

MAPLE

Has real tough time with Texas summers, deciduous, Red/Silver/Japanese var.

- *Anthracnose (fungus) – large blotches, main vein, surrounding tissue necrosis common
- Aphids – distorted leaves, honeydew, sooty mold
- Cankers (fungus) – sunken, dark lesions on bark, a sore
- Cottony-cushion scale / Mealybugs – twigs, limbs, trunk covered in cottony masses, honeydew, sooty mold
- *Exposed roots – probably not getting enough deep watering, high water requirements in heat
- Fungal leaf spot – bordered leaf spot – *Phyllostica*
- *Leaf scorch – leaf edges burning, wilting, very common, Fig. E-8A, 8B
- *Verticillium* Wilt (fungus) – leaves turn yellow at edges at first, then brown, peel bark on dead side reveals dark streaks, this is the most destructive Maple disease, treat in February

MESQUITE

Native, small, deciduous, fine texture, most soils

- No major pest problems
- Too much water

MULBERRY

Full sun, deciduous, water saturated soil can cause premature leaf drop, one of the first trees to loose its leaves

- Bacterial blight – brown water soaked spots on leaves and twigs
- Cottony-cushion scale – white cottony masses, honeydew, sooty mold
- Scale various
- Slime flux / Wetwood = bacteria, dark, wet-looking oozing smelly sap, usually in tree crotch, Fig. D-7
- *Webworms, Fig. I-13,14

OAK

Full sun, mainly deciduous, well drained soils

Red Oak – oak wilt, borers, sun scald, bacterial leaf scorch, cynipid wasps, Fig. D-11
Bur Oak – drought resistant, very large lobed leaves, 1-2" acorns, aphids, lacebugs
Blackjack – construction damage, mistletoe, indicates poor soil; prefers sandy soils
Chinquapin – sensitive to lawn chemicals and air pollution, discolored leaves, poor drainage, mildew
Pin Oak – no transplanting, sensitive to root construction damage, soil compaction, oak wilt, iron chlorosis,Fig. N-4
Live Oak – extreme cold will split bark, oak wilt, resistant to cotton root rot, insect galls
Shumard – most common red oak in D/FW, white scale, snow scale, pit making scales
Water Oak – iron chlorosis, Fig. N-4, root rot
Post Oak – can't be transplanted, extremely sensitive to construction damage, Fig. P-4, *Hypoxolyn* cankers

General Oaks:

- *Aphids – stippled colored leaves, distorted, honeydew, sooty mold
- Bleeding cankers (fungus) – sap oozing from elongated, knot-like cankers
- Borers – holes in bark, Fig. I-2, 2A
- *Hypoxylon* dieback (fungus) – forms as tree dies back
- *Leaf feeding caterpillars – many kinds, lacy leaf appearance, webbing
- Leaf scorch – leaf edge burning, bacterial leaf scorch, Fig. D-11
- Leaf spots – *Gnomonia quercina* – white – *Cristulariella*, dark – Septoria
- Oak anthracnose (fungus) – blotches, tissue necrosis, Fig. D-12
- *Oak galls – mostly made by insects, on twigs or leaves, leaf distortion – Cynipid Wasps, Fig. I-16, 17
- Oak leaf blister (fungus) – puckered blisters in spring, may be prevented by dormant spray/injection before bud swell – *Taphrina caerulescens*, Fig. D-10
- *Oak leafminer – dead tissue trails or patches on leaves, Fig. I-22
- *Oak mite – leaves are stippled yellow or bronze, dirty, webbing, honeydew
- *Oak skeletonizer – eats leaf tissue leaving the veins, Fig. I-15
- Oak wilt (fungus) – a Red Oak has no leaf sign and can die within a week, a Live Oak has vein discoloration and may die within 6 months – *Ceratocystis fagacearum,* Fig. 16A-E

- Pit scales – sunken green, golden or brown scaly bumps on twigs or branches during summer/fall, can delay new leaves up to a month in spring
- Squirrel twig cutting – jagged ended twigs or small branches girdled by chewing will kill sections of the canopy, Fig. E-12.
- Squirrel bark flaking, Fig. E-11

PALMS

- Cocos scale
- Iron deficiency
- Poor drainage
- Freeze damage
- Lethal yellows

PARASOL TREE, CHINESE or VARNISH TREE

Large, dark, green leaves, deciduous, smooth dark green trunk

- Heat / sun damage
- No major pest problems

PECAN

Full sun, well drained soil, deciduous, state tree of Texas

- *Aphids – stippled leaves, honeydew, sooty mold
- Borers – holes in bark
- Oils emitted from leaves may retard growth of nearby plants
- *Pecan scab (fungus) – leaf spots, elongated olive-brown lesions on veins, then large black spots, then defoliation, very limiting factor in nut production – *Cladosporium effusum*
- *Tent caterpillars – foliage defoliation and large tent-like webs
- Twig girdlers – cleanly cut twigs, ¼" to 2" diameter, Fig. I-19
- Walnut caterpillar, web patch on trunk, no tents
- *Webworms – foliage defoliation, webs smaller than tent caterpillar, Fig. I-13, 14
- Weevils – usually nuts, 1/8" holes
- *Zinc deficiency – small nuts, chlorotic, rosetting of leaves on ends of limbs and twigs, Fig. N-6
- Squirrels – jagged end cuts or complete girdling of small braches killing sections of the canopy, Fig. E-11, 12.

PINE

Evergreen, *prefers sandy, *slightly acidic soil, most don't do well in D/FW

- Air pollution – yellow flecked needles, red leaf tips possible with needle drop
- Needle rust (fungus) – cream-colored pustules on needles in spring, then rupture releasing bright orange spores – *Gleosporium*
- *Pine bark beetles – holes in bark, S-shaped egg tunnels in inner bar, oozing sap, leaves turn yellow-brown , orange-red brown; may find grubs in inner bark
- Pine needle scale – flattened white scaly bumps on needles

- Pine tip / shoot moths – branch tips turn yellow then brown and dry, in summer pitch accumulates around dead needles, at the base of needles or inside a brown resin tip to find cream-colored to red- brown ¾" worms
- *Pitch moth – sticky cream, yellow or pinkish pitch on bark
- Spruce spider mite – needles stippled yellow, webbing
- Wooly aphids – white wooly masses, needles turn yellow
- **Iron chlorosis, Fig. N-8

PERSIMMON

Small, rounded deciduous tree, well-drained, alkaline soils, bears edible fruit

- Tent caterpillars/ Webworms in mid-summer

PURPLE-LEAF PLUM

Sun, moist well drained soil, spring flowering – white, pale pink

- Peach tree borers
- Bacterial leaf spot

REDBUD

Semi-shade best, deciduous, any soil well drained, blooms pink or white before leaves, Eastern/Oklahoma/Forest Pansy, Weeping var.

- *Borers – holes in bark, bark trails
- Canker (fungus) – sunken lesion on bark
- Heat stress, Fig. E-8A, B
- Leafcutter ants – summer
- *Verticillium* wilt (fungus) – leaf edges turn yellow then brown, peel bark on dead area to reveal dark streaks

RED CEDAR, EASTERN

Pyramidal evergreen, native, any soil

- Bagworms, spider mites, Fig. I-18
- Bark and wood used to repel insects
- Allergy issues for humans

SWEETGUM

Full sun, deciduous, drought tolerant, *prefers sandy well drained acidic soil

- *Iron chlorosis – when roots hit limestone, yellow leaves, green veins, Fig. N-5
- Leafcutter ants – summer
- Sweetgum scale – small pits under leaves, first as yellow dots on leaf's upper surface
- Webworms

SYCAMORE

Full sun, deciduous, pealing bark

- Anthracnose (fungus) – main vein and surrounding tissue necrosis, treat in Feb., Fig. D-12
- *Leaf scorch – leaf edge burning – bacterial *Gloeosporium*, Fig. D-11
- Sycamore lacebugs – stippled colored leaf, black droplets under leaf
- Bacterial leaf scorch, Fig. D-11

WILLOW

Full sun, moist soil, short lived, Black/Weeping/Corkscrew

- Adventitious roots when flooded, develops on lower trunk and limbs, Fig. E-20
- Aphids
- Borers
- Thrips
- Do not plant near tile drains or sewer lines, invasive roots

WALNUT, BLACK

Deciduous, deep moist soils

- *Oils emitted from leaves may retard growth of nearby plants
- Webworms, Fig. I-13,14
- Difficult to transplant

5 QUESTION POP TEST/REVIEW

- **1. WHAT DO SUCKING INSECTS PRODUCE/CAUSE?**

- **2. WHAT PRODUCES SIDE BY SIDE HOLES IN A TREE?**

- **3. NAME A DEADLY DISEASE THAT CLOGS THE VASCULAR SYTEM OF A TREE AND IS SPREAD BT ROOT GRAFTING AND INSECTS**

- **4. WHAT TYPE OF INSECT REMAINS ON THE TREE EVEN AFTER IT'S DEAD? HOW DO WE KNOW THE INSECT IS DEAD?**

- **5. WHAT ELSE BESIDES INSECTS AND DISEASES CAN CAUSE HARM TO TREES?**

QUESTIONS
COMMENTS

- **Samples**
- **Check out the books**
- **Sad tales**