Developing an Effective Scouting Program

Steve Tjosvold
University of California Cooperative Extension
Santa Cruz and Monterey Counties

Why is scouting so important today?

- Backbone of Integrated Pest Management (IPM)
- Fewer pesticides; expensive
- New pesticides often target specific pests / life stages or diseases and require precise timing
- Biological control often requires information on pest and predator/parasite numbers
- Invasive pests and diseases require detection at very low levels. Regulatory action can have a profound economic impact.

What is Scouting ?

Inspection, Data Collection and Evaluation of Pests and Diseases

Scouting Goals

- Locate and identify pests and diseases
- Quantify insect numbers and disease severity
- Determine treatment timing and type
- Evaluate effectiveness of treatments

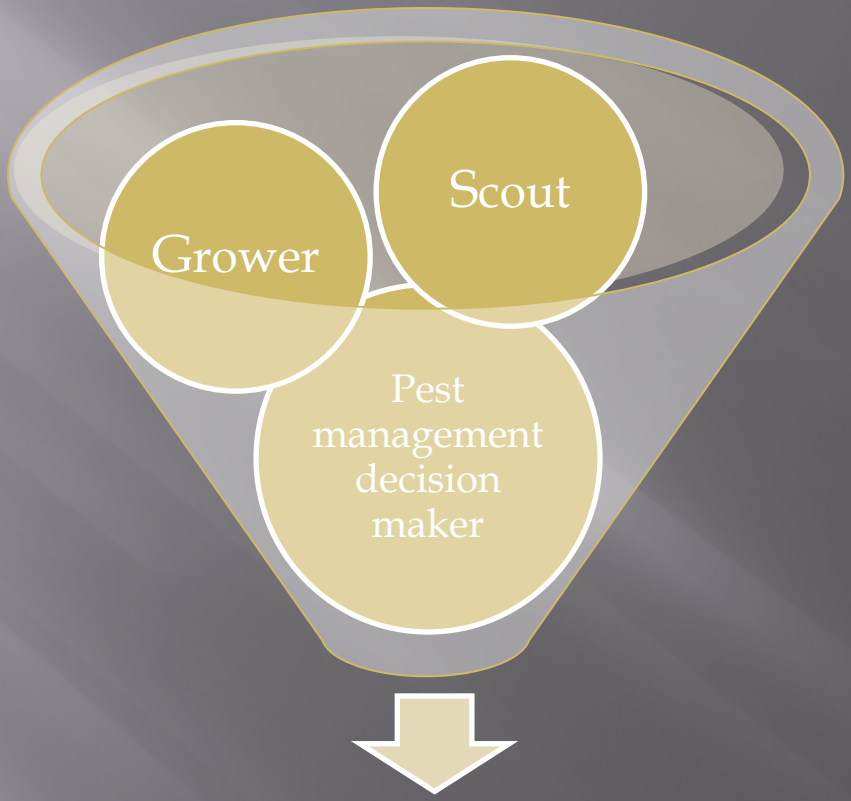
Presentation Outline

- Basics
- Tools
- Sampling methods
- Types of damage
- When does it start?
- Record keeping
- Scouting for Light Brown Apple Moth

Basics
Knowledgeable and well trained staff

- Pest and disease biology
- Pests and diseases on specific crops
- Seasonal pest trends
- Pest action thresholds
- Control measures

Basics: The Pest Management Team



Pest Management Action

Scouting Maps and Equipment

- Nursery map, crop maps, and more detail as needed
- Hand Lens, Optivisor, Dissecting Scope
- Flagging Tape, Flags
- Sticky Cards and other monitoring devices
- Hand Counter
- Plastic Bags, Waterproof Marker, Cooler
- Clipboard, Data Sheets

Detection and quantifying insects

Sticky cards: positioned vertically just above the crop or at vents

Detection and quantifying insects Sticky cards

- Trap Density depends on Pest
  - Whitefly 1 per 1000 ft2
  - Leafminer 1 per 10,000 ft2
  - Thrips 1 per 20,000 ft2
- Traps checked and counted weekly
  - Vertical orientation, just above crop

Detection and quantifying insects

Plastic wrap cover

Short cut: count a 1 inch band on both sides of card

Detection and quantifying insects

Tape for scale insects

- Double-sided sticky tape
- Used to monitor scale crawlers
- Place 2 or more traps in each of 2 or more plants at each location before crawlers hatch
- Locate traps near female scales

Detection and quantifying insects

Potato for fungus gnat larvae

One-inch cubes of raw potato placed in top 1/2 inch of soil. 10 cubes per 1000 to 10,000 square feet. Check weekly or biweekly.

Plant inspection

- Look where you expect to find the pest or disease
- Look for signs and symptoms of problem
  - Sign = the pest or pathogen
  - Symptom = Feeding damage or the disease symptoms

Plant inspection

Sampling strategy

- Targeted to known problem areas or host plants
- Random
- Quantify what is sampled in some way (e.g. # per plant, # infested plants per block, high, low, none)

Plant inspection

Symptoms and signs

Thrips damage on calyx

If the crop is blooming, sample flowers for insects such as thrips that damage flowers (# per bud, # per plant)

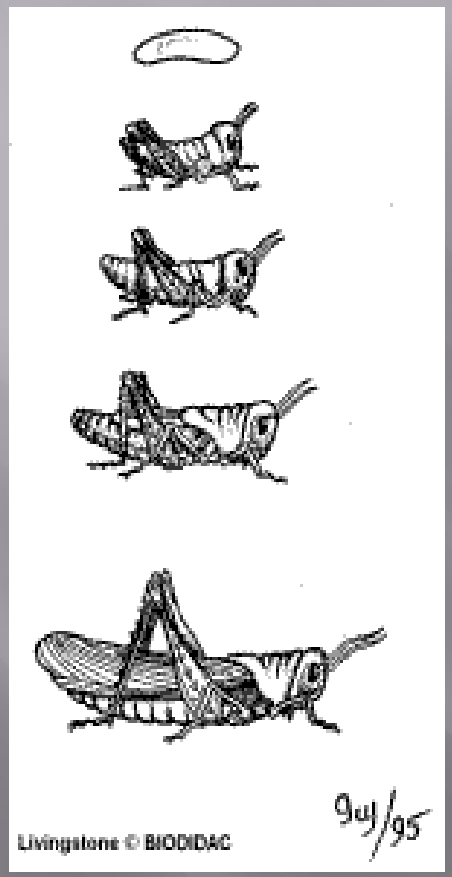
Tapping Method

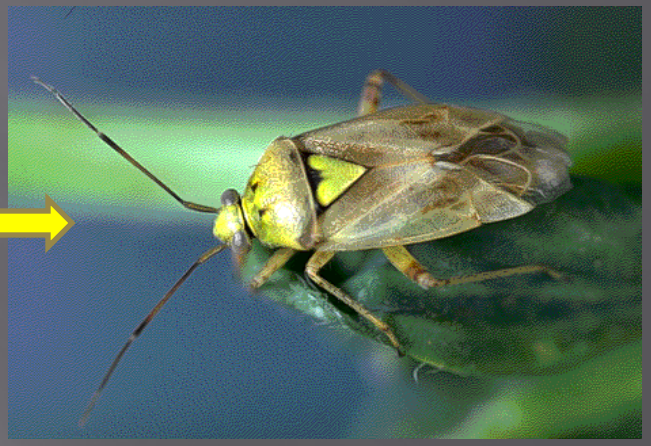
Plant inspection
Symptoms and signs

- Sample by holding a white tray, sheet or clipboard beneath the branch as a collection surface. Shake the branch or hit it two or three times with a stick
- Used for most exposed, readily dislodged insects and mites
- As with all sampling methods, be consistent

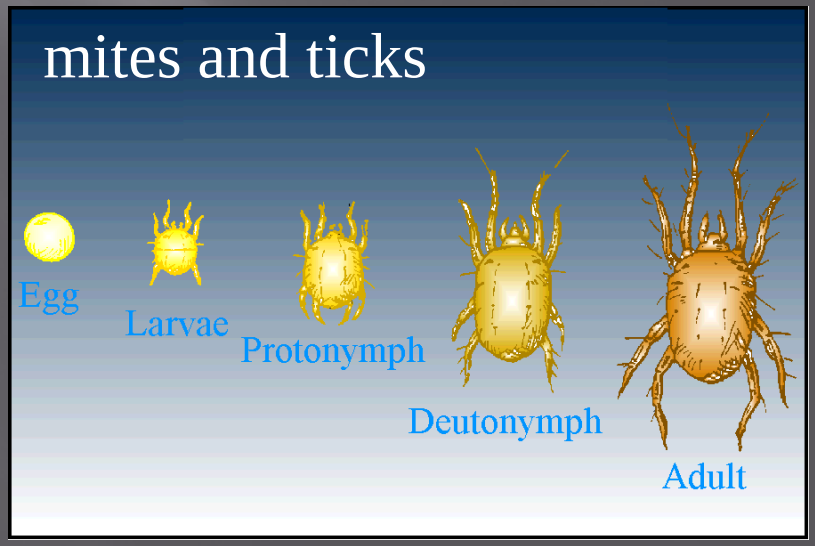
Plant inspection
Symptoms and signs

Sometimes immature insects and mites look similar to adults





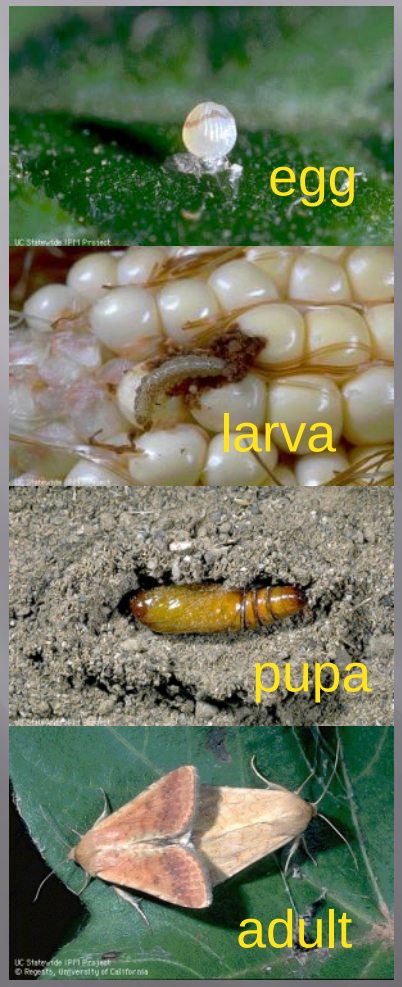
Examples: leafhoppers, Lygus bugs, grasshoppers, crickets, termites, mites.



Plant inspection
Symptoms and signs

Sometimes immature insects do not look similar to adults.

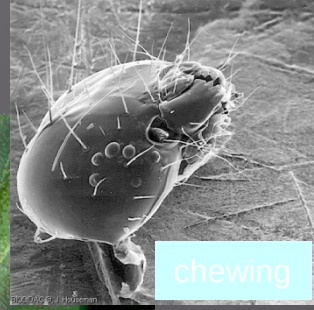
Corn earworm



- egg
- Larva(e) - feeding, destructive stage
- pupa(e) - an inactive stage
- adult - reproductive stage

Examples: bees, ants, wasps, flies, beetles, butterflies, moths and mosquitoes

Plant inspection
Symptoms and signs

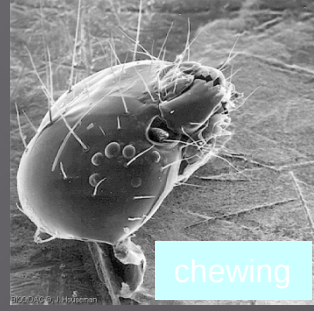


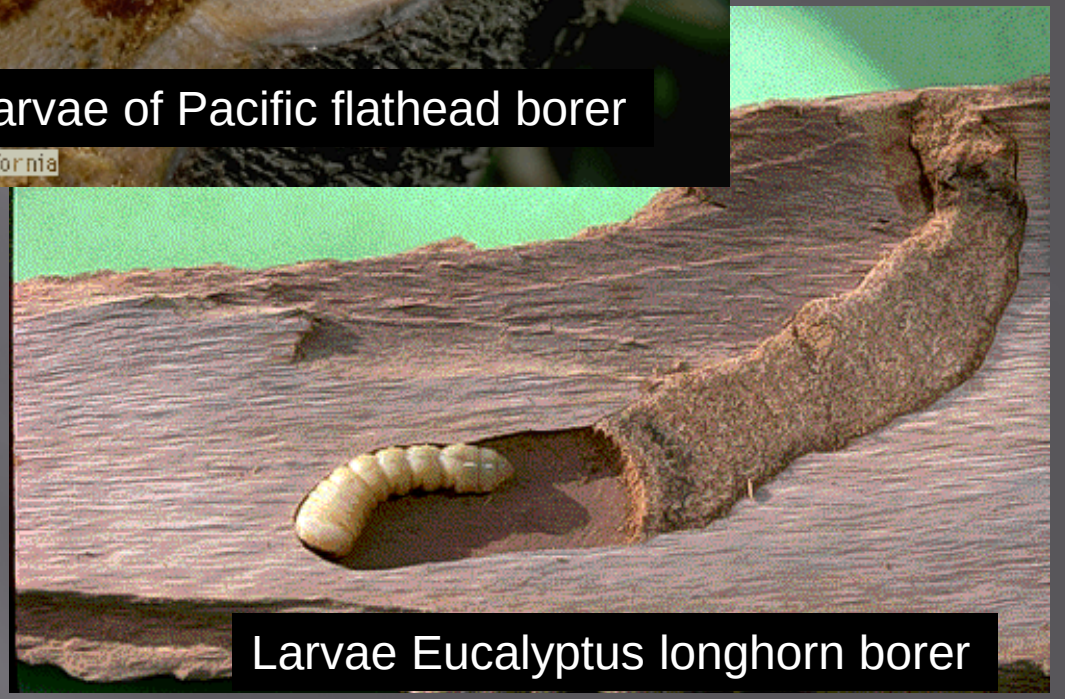
Insect feeding - mined leaves

Leaf miner injury caused by developing fly larvae growing and tunneling inside tomato leaf

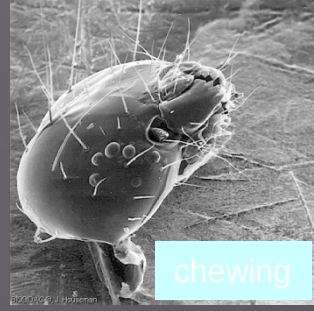
Fully developed larvae

Dieback of twigs, shoots or entire plant, stems, branches.

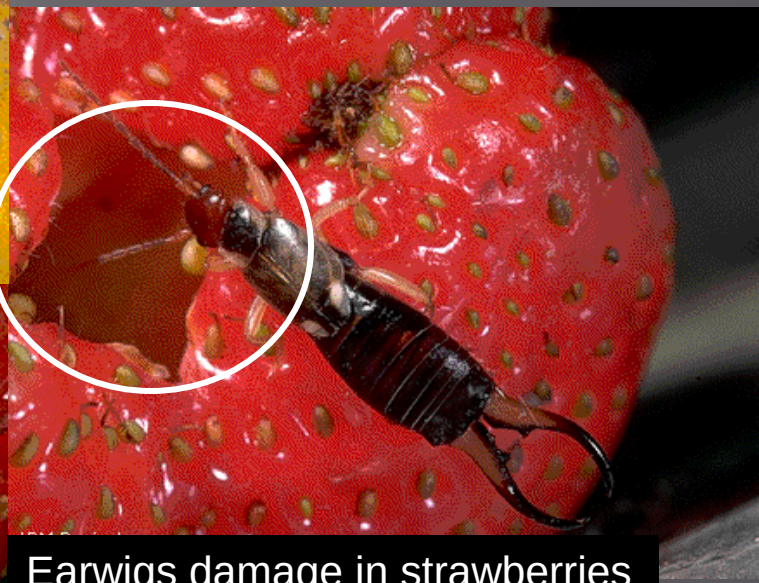




Feeding by insect, snail and slug !



European brown snail feeding on citrus fruit

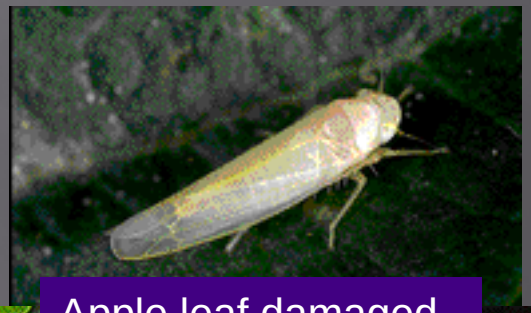


Earwigs damage in strawberries

Slugs eat holes in strawberries

Feeding by piercing sucking insects

Grape leafhopper



Apple leaf damaged by rose leafhopper

Dead plant cells resulting from feeding by piercing sucking insects (I.e. leafhoppers) create tiny yellow dots, called STIPPLING

Spider mite damage

Feeding by piercing sucking insects on fruit

Lygus bugs

Symptoms or signs of insect attack

Presence of insect, or insect-related, products on plants

Insect frass

sooty mold

Presence of insect, or insect-related, products on plants

Presence of insect, or insect-related, products on plants

wax

Presence of insect, or insect-related, products on plants

Webbing and leafrolling

Disease:
Symptoms and signs

Detection may depend on the stage of development

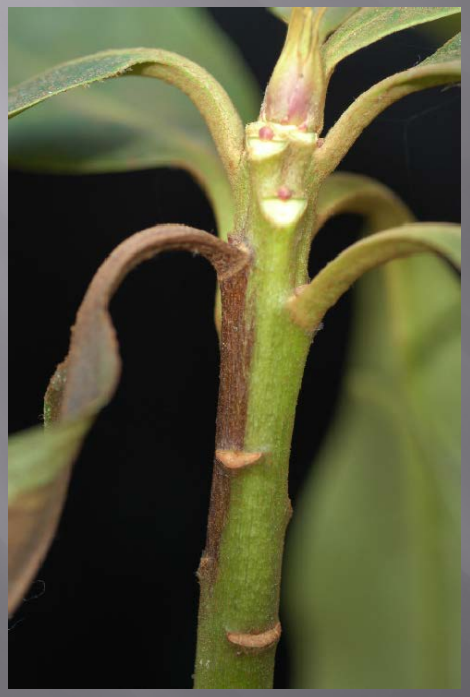
Botrytis (Gray mold)

Sudden Oak Death (SOD) Symptoms

Rhododendron

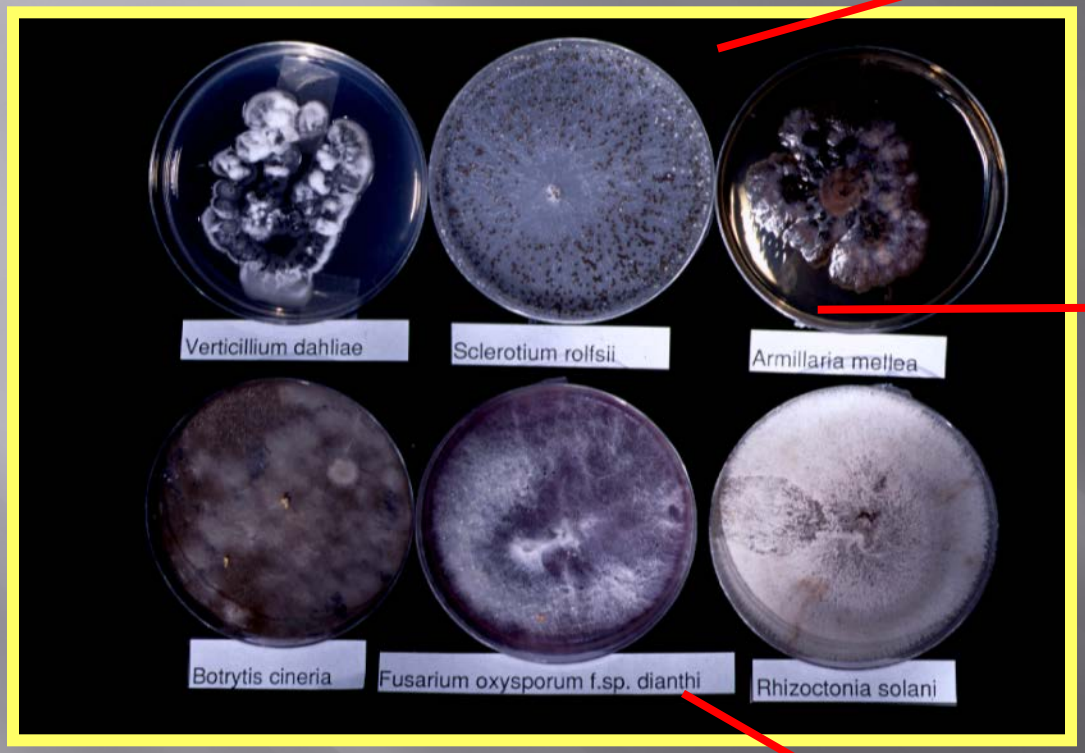
Camellia

Pieris

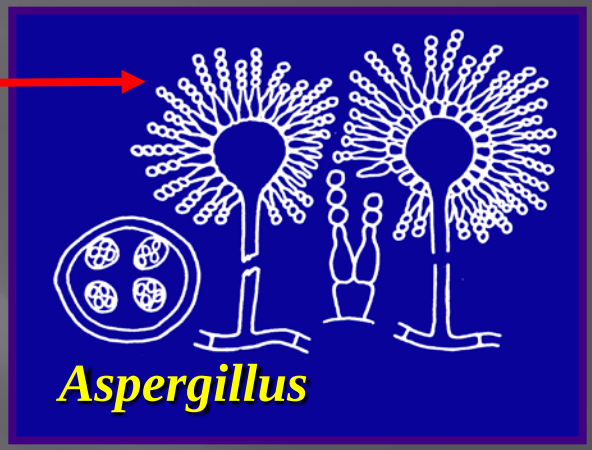


Viburnum

Get proper diagnosis


Verticillium dahliae
Sclerotium rolfsii
Armillaria mellea
Botrytis cineria
Fusarium oxysporum f.sp. dianthi
Rhizoctonia solani


Cladosporium


Aspergillus


Alternaria

Scouting: identifying diseases in the nursery

- Root Pathogen Detection Kits
  - Phytophthora
  - Pythium
  - Rhizoctonia
- Virus Detection Kits
  - Tomato Spotted Wilt and Impatiens Necrotic Spot Viruses

When Does Scouting Start?

Record Keeping

- Pest species, life stages, and abundance
- A measure of the damage or infestation (e.g. %plants)
- Location (flag it in field too)
- Environmental conditions
- Time involved in scouting and in applying control measures
- Cost of control measures

The summarized report
to pest management decision maker

What, where, and how many ?

Insect population trends: increasing or decreasing?

Results from past treatments?

A Scouting Strategy for Light Brown Apple Moth (LBAM)

Pest Exclusion
LBAM can be introduced on nursery stock

- Know inherent crop risk
- Know source / location risk
- Inspect incoming shipments and returns
  - Consignment plants
  - Liners and cuttings
  - Plant returns
- Temporarily quarantine introduced high risk plants and treat if suspects detected

HOST PLANTS

Over 250 plant species, 50 families, and 120 genera.
Herbaceous plants preferred over woody plants
Remember the weeds!

Adiantum sp., *Aguilegia* sp., *Amaranthus* sp., *Arbutus* sp., apple (*Malus domestica*, *Malus* spp.), apricot (*Prunus armeniaca*), *Artemesia* sp., *Astartea* sp., *Aster* sp., avocado (*Persea americana*), *Baccharis* sp., black alder/European alder (*Alnus glutinosa*), blackberry and raspberry (*Rubus* spp.), black poplar (*Populus nigra*), blueberry (*Vaccinium sp.*), *Boronia* sp., *Brassica* sp., *Breynia* sp., broad bean (*Vicia faba*), broadleaf dock (*Rumex obtusifolius*), *Bursaria* sp., butterfly bush (*Buddleia* sp.), *Calendula* sp., *Callistemon* sp., camellia (*Camellia japonica*), *Campsis* sp., capeweed (*Arctotheca calendula*), *Cassia* sp., *Ceanothus* sp., Chinese gooseberry (*Actinidia chinensis*), *Choisya* sp., chrysanthemum (*Chrysanthemum* sp.), citrus (*Citrus* spp.), *Clematis* sp., *Correa* sp., cotoneaster (*Cotoneaster* sp.), *Clerodendron* sp., clover (*Trifolium repens*, *Trifolium* sp.), *Cupressus* sp., curled dock (*Rumex crispus*), currant (*Ribes* sp.), *Cydonia* sp., *Dahlia* sp., *Datura* sp., *Daucus* sp., *Dodonaea* sp., *Eriobotrya* sp., *Eriostemon* sp., *Escallonia* sp., eucalyptus (*Eucalyptus* sp.), euonymus (*Euonymus* sp.), fat-hen (*Chenopodium album*), *Forsythia* sp., *Fortunella* sp., fox's brush (*Centranthus* spp.), *Gelsemium* sp., *Genista* sp., *Gerbera* sp., gorse (*Ulex europaeus*), grape (*Vitis vinifera*, *Vitis* sp.), *Grevillea* sp., *Hardenbergia* sp., hawthorn (*Crataegus* sp.), hebe (*Hebe* spp.), *Helichrysum* sp., hop (*Humulus lupulus*), horn of plenty (*Feijoa sellowiana*), ivy (*Hedera helix*, *Hedera* spp.), jasmine (*Jasminum* spp.), *Juglans* sp., kiwifruit (*Actinidia deliciosa*), *Lathyrus* sp., *Lavendula* sp., *Leucodendron* sp., *Leptospermum* sp., *Linus* sp., litchi (*Litchi chinensis*), *Lonicera* sp., alfalfa (*Medicago sativa*), *Lupinus* sp., *Lycopersicum* sp., *Macadamia* sp., malabar ebony (*Diospyros* sp.), *Mangifera* sp., *Melaleuca* sp., *Mentha* sp., *Mesembryanthemum* sp., *Michelia* sp., *Monotoca* sp., montbretia (*Crocosmia* sp.), *Myoporum* sp., oak (*Quercus* sp.), *Oxalis* sp., *Parthenocissus* sp., peach (*Prunus persica*), pear (*Pyrus* sp.), *Pelargonium* sp., *Persoonia* sp., *Petroselinum* sp., persimmon (*Diospyros kaki*), *Philadelphus* sp., *Photinia* sp., *Pittosporum* sp., pine (*Pinus* muricata, *P.* radiata, Pinus sp.), plantain / ribwort (*Plantago lanceolata*), *Platysace* sp., *Polygala* sp., *Polygonum* sp., poplar and cottonwood (*Populus nigra*, *Populus* sp.), potato (*Solanum tuberosum*), privet (*Ligustrum vulgare*, *Ligustrum* sp.), *Pteris* sp., *Pulcaria* sp., *Pyllanthus* sp, *Pyracantha* sp., *Ranunculus* sp., *Raphanus* sp., *Reseda* sp., raspberry and boysenberry (*Rubus idaeus*, *Rubus* sp.), rose (*Rosa* sp.), *Salvia* sp., *Senecio* sp., Scotch broom (*Cytisus scoparius*), *Sida* sp., *Sisymbrium* sp., *Smilax* sp., *Sollya* sp., St. John's wort (*Hypericum perforatum*), strawberry (*Fragaria* sp.), *Tithonia* sp., *Trema* sp., *Triglochin* sp., *Urtica* sp., *Viburnum* sp., *Vinca* sp., wattle (*Acacia* sp.), willow (*Salix* sp.).

Pest Exclusion

LBAM can be introduced from surroundings

Pest Exclusion

LBAM can be introduced from surroundings

Strategic monitoring

Look for LBAM life stages (signs) and symptoms

LBAM life stages

Adult moth

Egg mass

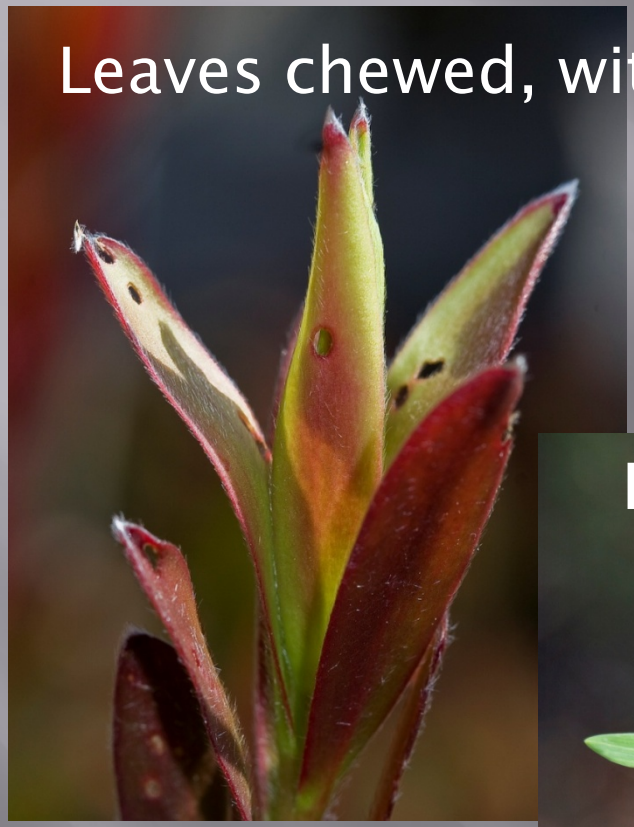
Pupa

Larva

Symptoms at shoot tips

Leaves bound together with silk-like webs or threads

Leaves chewed, with holes



Leaves distorted

Scouting strategy

Target:

- Growing plants
- Growing points
- Common hosts

Scouting strategy

Target plants at or outside the nursery perimeter

Hedgerow and visual screens

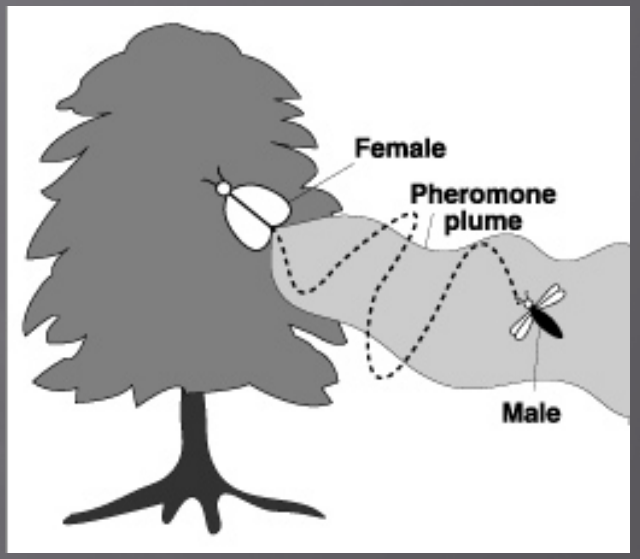
Experiment: SPLAT LBAM HD (ISCA Technologies, Inc)
+ Hopper Stopper Sticky Tape

Coast Redwood basal sprouts

Trap Monitoring

Pheromone traps

- Selective synthetic pheromone attracts migrating male moths and kills
- Place near high risk hosts and nursery perimeters near known infestation
- Hung above crop
- Use USDA official detection data if available.
- Pheromone can be purchased
  - Suterra (Bend, Ore.)
  - ISCA Technologies (Riverside, CA.)



Male LBAM pheromone septum attractant in Jackson trap

Pheromone Trap monitoring effectiveness Not created equal

Treatments

Jackson trap with 3 mg Suterra lure

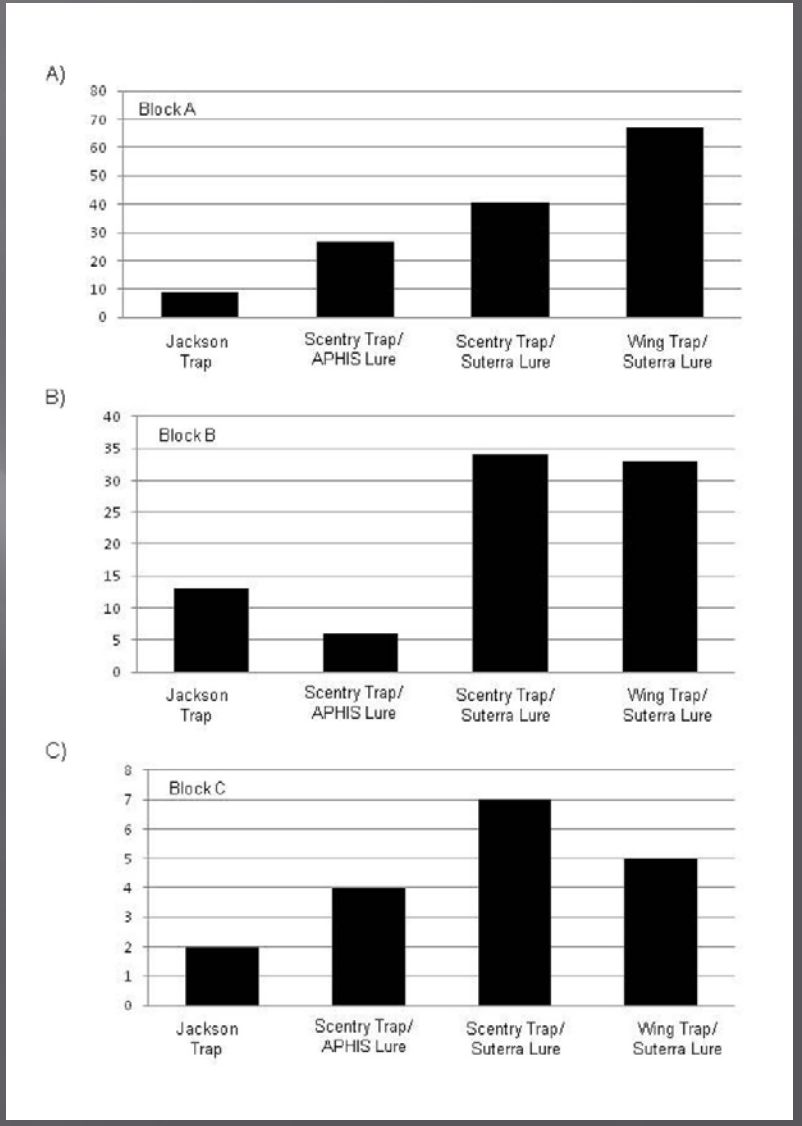
Red Scentry® Delta trap with 3 mg Suterra lure

Red Scentry ® Delta trap with 3 mg APHIS-supplied lure

Red Suterra wing trap baited with 3 mg Suterra lure

3 sites (blocks), 4 traps per site

Average male LBAM captured over four weeks using four different pheromone trap and lure combinations



F. Zalom, et.al. (unpublished)

Other Trapping Methods

Bait bucket-traps (3 possible baits)

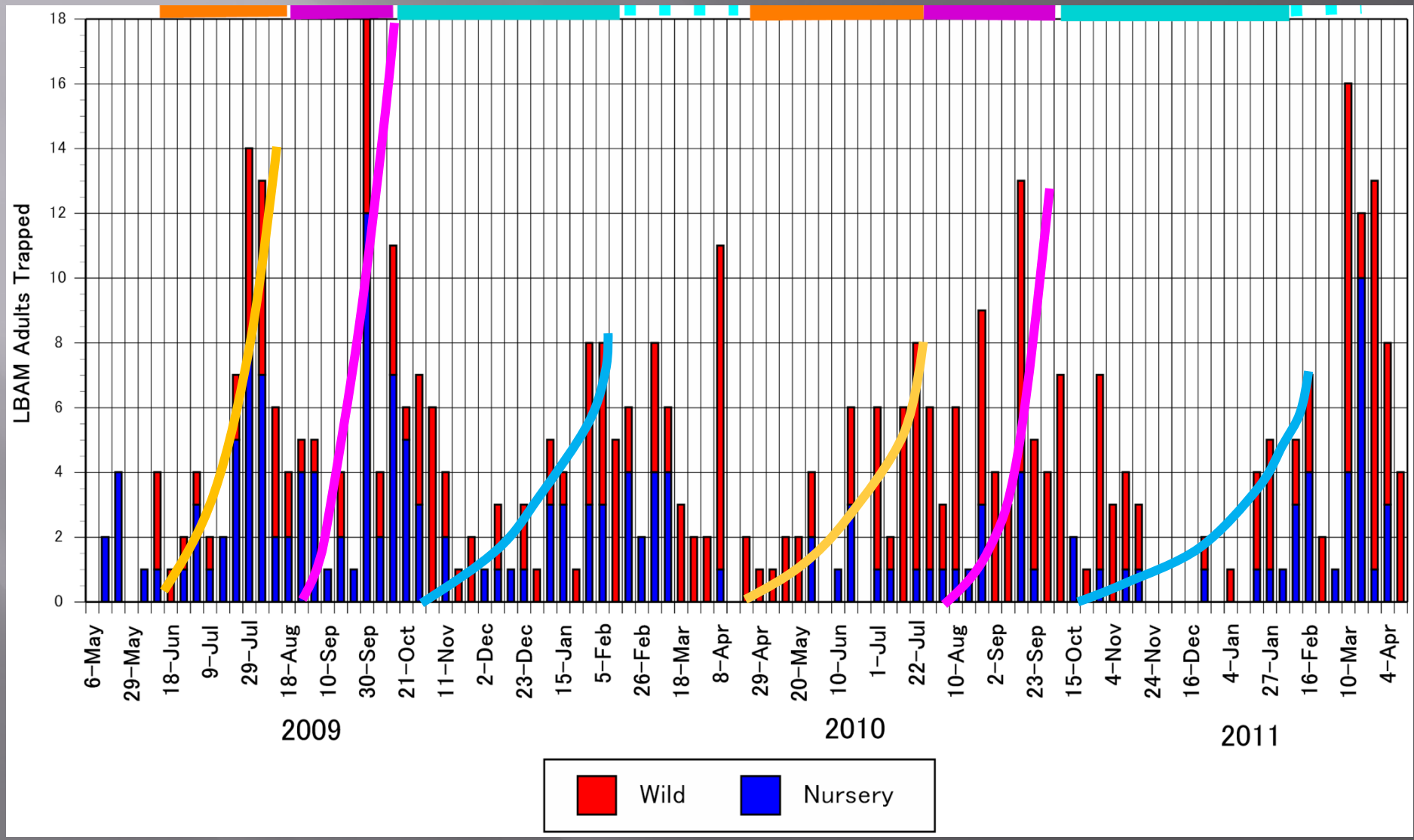
1. Terpinyl acetate and brown sugar solution
2. Vinegar (acetic acid)
3. Port wine

Ultraviolet-light trap

Monitor, Record, and Evaluate

- Monitor with pheromone and bait traps for adults
  - Target eggs at or near peak adult emergence
  - Target migrating moths at nursery perimeters
- Scout for larvae by searching for symptomatic leaves, then for a "suspect" life stage.
  - Biweekly in winter
  - Weekly in summer
  - Before an official inspection
- Prioritize scouting to high risk areas, plants, or perimeters adjacent to infested areas.

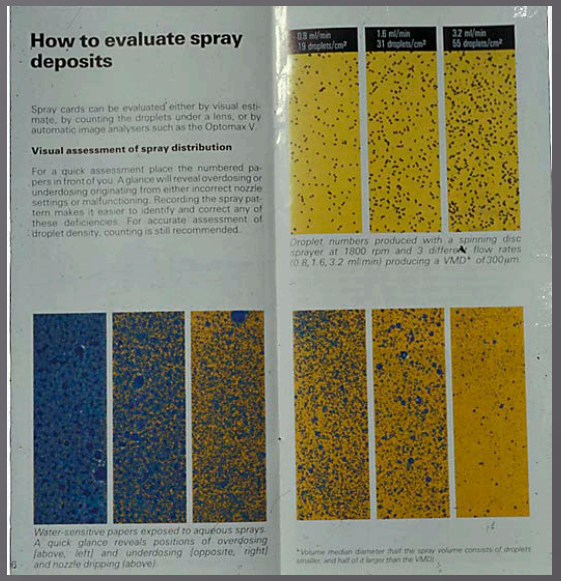
LBAM Adult Catch in Pheromone and Bait Traps

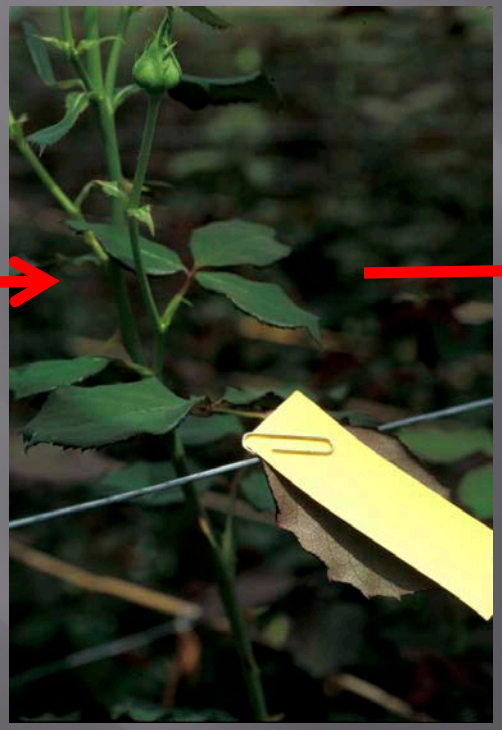


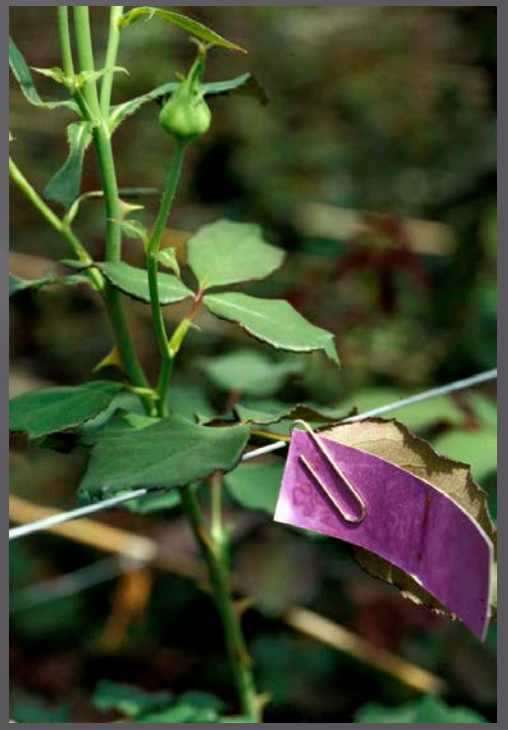
Pesticide Efficacy

Evaluation of Spray Application

Water Sensitive Paper
TeeJet Spraying Systems Co.







Final comments

- Identify the pest or disease
- Start scouting efforts simply and then expand efforts as needs or time allow
- Record: presence, absence (good) or quantity (better)
- Cover the entire production area and perimeters at least every 1 or 2 weeks
- Scouting is a team effort
- Develop a pest management history that can be used by others