



Identifying Swarming Termites

Some areas of California experienced the first rains of the fall season in September, accompanied by swarming alate (winged) termites. UC Cooperative Extension offices, and especially Master Gardener programs, throughout the state received numerous requests from members of the general public for identification and management information about these 'unknown' insects 'flying out of the ground' or 'trapped inside the house'. In most cases, subterranean termites, *Reticulitermes* spp., were the culprits; but specimens of drywood termites, *Incisitermes* spp., and dampwood termites, *Zootermopsis* spp., were also recovered.

When submitted specimens are identified as termites, Master Gardeners are trained to send their clients the UC IPM publication *Pest Note: Termites* (<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7415.html>) and suggest they contact a pest management professional (PMP) specializing in wood-destroying organisms. For these PMPs, swarm season creates opportunities to help new customers manage potential termite infestations using the

principles of integrated pest management (IPM).

The first step in any pest management program should be identification. Luckily, alates of California's three most common termite species are relatively easy to distinguish (Fig. 1). Subterranean termites are the smallest of the three (8-10mm, including wings), have dark brown to blackish bodies and translucent brownish-gray wings, and emerge from underground colonies (Fig. 2). Drywood termites are slightly larger (11-12mm, including wings), with brown bodies and smoky, black-veined wings. Dampwood termites are the largest species in the state (up to 25mm, including wings), with yellow-brown bodies and large membranous brownish-gray wings.

All three species are known to produce swarms in the fall, on sunny days following a rain for most subterranean species (Formosan subterranean termites, *Coptotermes formosanus*, found only in parts of San Diego County, fly during warm, humid evenings), during warm days for drywood species, and on warm evenings for dampwood termites. Spring swarms are not uncommon for subterranean species, and both drywood and dampwood species are also known to swarm in summer.

Presence of winged termites does not necessarily mean that structures at the collection site are infested, since termites are good fliers and



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Figure 1. Alate specimens of California's most common pest termite species (left to right); Pacific dampwood termite, Zootermopsis angusticollis; western drywood termite, Incisitermes minor; and western subterranean termite, Reticulitermes hesperus.



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Figure 2. Western subterranean termites swarm from an underground colony on a sunny day following the first fall rain of the season.

may have come from other structures or even from distant dead trees or buried wood. Furthermore, alates of dampwood and Formosan termites are attracted to lighting at night and so may become trapped in porch entryways or even indoors when windows are open or screens are broken.

Thorough inspection, detection, and delimitation should be performed to confirm suspected termite infestations before effective management can proceed. The nature of these services will

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Swarming Termites

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depend on the termite species:

- **Subterranean termite** colonies (with the exception of the Formosan subterranean termite) require contact with soil moisture at all times. Therefore, inspections focus on structural components in contact with or in close proximity to the ground. Shelter tubes (Fig. 3) constructed up concrete foundations are clear signs of activity. Wooden and cellulose monitors can be installed underground near structures to detect subterranean termite activity when structural inspection is too difficult. Moisture meters may also be used to detect conditions conducive to subterranean termite infestations within structural wood.

- **Drywood termites** require no contact with the soil and can therefore be found feeding deep within structural wood members many meters above the ground. Often, the only visible evidence of an infestation will be the plugged original 3mm wide drill hole(s) made by the colony founders and piles of brownish fecal pellets

under kickout holes or cracks in the infested wood. Visual detection can therefore be almost impossible when infestations occur in inaccessible areas and structural voids. Thankfully, many tools and devices exist to help PMPs detect and delimit drywood termite infestations: termite-sniffing dogs, acoustic emissions devices, microwave, fiber optic borescopes, infrared cameras, and moisture meters have all been used successfully. Recent research within the laboratory of Dr. Vernard Lewis at UC Berkeley evaluated the accuracy of different detection devices, reporting on strengths and weaknesses (see full report: <http://www.pestboard.ca.gov/howdoi/research/ucbfinal.pdf>).

- **Dampwood termites** require wet or even saturated wood within which to feed and nest. Such conditions are usually only found when wood is buried underground, in contact with moist soil, periodically flooded, constantly shaded or covered with moist vegetation, or when plumbing or roof leaks ensure regular moisture. Inspec-



J. K. Clark, UCIPM

Figure 3. Exploratory shelter tubes of subterranean termites on a concrete basement wall.

tions targeting dampwood species should therefore concentrate on these situations and areas.

Successful species identification, detection, and delimitation of termite infestations are major components in an IPM program. These steps are required to implement appropriate preventive measures when infestation pressure is recognized and to prevent unwarranted and unnecessary pesticide applications.

-Andrew Sutherland, UC State-wide IPM Program, San Francisco Bay Area, amsutherland@ucanr.edu

Two New Stink Bugs in California

Over recent months, there have been numerous reports of two new invasive stink bugs in new areas of California. Both stink bugs are likely to cause problems in gardens and may also be found aggregating in homes as the weather turns cool and wet. They may produce an unpleasant odor, which makes them a special nuisance in homes.

The brown marmorated stink bug feeds on a wide range of plants from fruit trees to vegetables and shade trees. The *Bagrada* bug is primarily a problem on plants in the mustard family and is already well established in many parts of southern California. For more information on these new pests, see the UC IPM web site <http://www.ipm.ucdavis.edu/pestalert/pabrownmarmorated.html> and www.ipm.ucdavis.edu/pestalert/pabagrada.html.



S. Dara, UCCE, San Luis Obispo

Figure 1. *Bagrada* bug adult and nymphs. This is a small stink bug, 1/4 to 3/16 inch long as an adult.



K. Windbiel-Rojas, UCIPM

Figure 2. Brown marmorated stink bug adult, about 1/2 to 2/3 inch long. Note white bands on antennae.

Downy Mildew Clobbers Impatiens

One of California's most adored flowering plants, impatiens, is being threatened by a serious pest. You've probably noticed the common garden impatiens missing from nurseries and other suppliers, retail store shelves, and landscapes, parks, and gardens this year. What is going on? What is the problem?

The Disease

Impatiens are dying from a relatively new plant disease called impatiens downy mildew, caused by the fungus-like, oomycete pathogen *Plasmopara obducens*. Although a problem for growers in wholesale nurseries since 2004, impatiens downy mildew has only recently started to affect plants in gardens and landscapes in California. The pathogen primarily affects varieties of *Impatiens walleriana*, or hybrids with an *I. walleriana* parent and wild impatiens (*I. balsamina*). Note that this pathogen does not affect New Guinea impatiens (*Impatiens hawkeri*) or other bedding plant genera.

This disease develops rapidly, with a few leaves on apparently healthy impatiens beginning to show slight yellowing and stunting (Fig. 1) followed by development of white, powdery spores on the undersides of leaves (Fig. 2), and later, by leaf and flower drop. Plants are likely to become completely defoliated within several weeks (Fig. 3). The pathogen produces airborne spores, which can travel for many miles, as well as swimming zoospores and oospores, which can survive within soil and plant debris for long periods and infect healthy plants when replanted in the same area.

What Landscape Managers Should Do

Early detection is especially critical for this disease since chemical control has been shown to be ineffective once sporulation begins.



M. Daughtrey, Cornell University

Figure 1. Early symptoms of impatiens downy mildew showing stunting and yellowing of leaves (left and middle); healthy leaf on right.



M. Daughtrey, Cornell University

Figure 2. Sporulation of downy mildew on underside of impatiens leaf.



M. Daughtrey, Cornell University

Figure 3. A planting of apparently healthy impatiens around a tree (left) and plants decimated 5 weeks later (right).

Follow these inspection and cultural procedures to help limit the spread:

- Scout routinely to identify and remove diseased plants before epidemics can result.
- Turn leaves over to check for sporulation on the undersides of leaves.
- Reduce humidity by increasing plant spacing and air flow; avoid overhead watering; however, if used, apply water early in the day to allow for the drying of leaves by the afternoon.
- Destroy and dispose of infected plants by bagging and putting them in the trash. Composting will not destroy spores.

What to Look For

The first signs of disease are yellowing of a small number of leaves and stunting, followed by white sporulation on the undersides of leaves (Fig. 2), and finally leaf and flower drop. Look for these symptoms:

- Yellowing leaves that look similar to a nutrient deficiency.
- Leaves curl downward and may show stippling.
- The plant drops leaves and flowers.
- Fuzzy-looking growth on the underside of the leaves. These are structures that contain the spores that spread the disease.

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Downy Mildew

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What to Do If You Find It

If you find a plant that appears to have impatiens downy mildew, remove the impatiens from the landscape, bag the plants, and dispose in the trash. Infected plants should not be composted. Fungicides are unlikely to provide reliable control in landscapes, whereas removing infected plants may limit spread to other areas of the landscape.



J. K. Clark, UC IPM

Figure 4. Begonias can be a planting alternative to impatiens.

Alternative Plants Used as Substitutes for Impatiens

Provide clients with suggestions about alternative bedding plants that grow well in shady areas of the landscape but will not be affected by the disease (Table 1).

Although few plants give the same look as garden impatiens, there are still many great bedding plant options available. Depending on the conditions in your area, you can suggest alternative plant choices that grow well in the shade.

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Table 1. Bedding plants that may be good alternatives to impatiens in some areas of California.

Begonia hybrids
Cast-iron plant (<i>Aspidistra elatior</i>)
Caladiums
Clivia (<i>Clivia miniata</i>)
Coleus
Coral bells (<i>Heuchera hybrids</i>)
<i>Corydalis lutea</i>
Lady's mantle (<i>Alchemilla mollis</i>)
Lobelia
Maiden's wreath (<i>Francoa ramosa</i>)
New Guinea impatiens (<i>Impatiens hawkeri</i>)
Sweet alyssum
Wax begonias
Yellow archangel (<i>Lamium galeobdolon</i>)



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Pruning and Tree Physiology: *The Bad and The Ugly**

P *runing in Practice*

Pruning is perhaps the most common tree maintenance activity that is undertaken on urban and ornamental trees. This is in sharp contrast with forest trees, which are pruned only in exceptional cases and yet grow and develop their mature form quite well, living considerably longer than urban trees. This tells us that trees do not require pruning in order to survive.

Nevertheless, in ornamental landscapes, pruning can be beneficial for maximizing the benefits of trees, and in young trees pruning "...provides the greatest benefit of any cultural practice in influencing the future structure, appearance, and maintenance costs." (Harris, Clark, Matheny, 1999; p 422.). In addition, pruning may be critically important for tree health, whether managing a pathological condition or correcting poor tree form (we will revisit these ideas in a future article). Below, we focus on the effects of pruning on tree physiology and the mechanisms by which pruning may predispose trees to insect or



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A coast live oak (Quercus agrifolia) in the initial stages of decline from Armillaria root rot.

disease problems. We are primarily considering ornamental trees in landscapes; fruit trees require somewhat different considerations.

Pruning Effects on Tree Physiology

Removing branches has at least three effects on tree physiology: it diminishes the tree's energy capture ability, draws down the stored energy reserves, and alters the growth pattern of the tree.

Potential energy capture by photosynthesis is reduced after pruning, as the total leaf area (the "sugar factory") is diminished. Additional energy reduction occurs because the starch reserves that had been stored in the removed branch are lost. These two losses can range from negligibly small (e.g., when small twigs are trimmed), to catastrophically large (e.g., when mature trees are "topped," which severely shortens the large branches).

Tree growth is affected in a somewhat paradoxical way, in that the growth of an individual shoot is "invigorated" (i.e., increased) by pruning as the tree's root system is able to direct more water and nutrients into those shoots that remain after pruning. Yet, considered as a whole, a pruned tree will produce less total growth (compared to an un-pruned tree) as its

photosynthetic capacity was (at least temporarily) reduced by pruning.

Pruning Effects on Tree Defense Systems

Pruning also affects a tree's ability to resist pathogens and insects, in both direct and indirect ways. In direct terms, the pruning wound presents a potential site of pathogen entry into the tree, an "infection court," and allows the pathogens to bypass the tree's defense layers. Heartwood, for example, is usually shielded from wood-rot fungi by the bark and sapwood but becomes exposed in branch stubs left after topping cuts. In addition, some insects are attracted to fresh pruning cuts, and these pests can either cause a problem by themselves or by transmitting a pathogen (e.g., some elm bark beetles attracted to pruning cuts are vectors of Dutch elm disease).

Furthermore, large-scale pruning predisposes the tree to insect or pathogen attack by reducing the total energy available to the tree (as described above), thereby limiting the tree's capacity to use this stored energy to defend itself from insects or pathogens by producing defensive compounds (such as pitch) or by limiting the

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* (the "good" will appear in a future Green Bulletin)

Proper Pruning Technique

All pruning should be done using proper techniques and following the appropriate work protocol to ensure jobsite safety. At a minimum, the pruner should be familiar with the concept of "natural target pruning" as articulated by Alex Shigo and incorporated into standard practice within textbooks (e.g., "Arboriculture" by Harris, Clark, and Matheny), and professional standards (ANSI A300).

Special situations – palms, large and/or old trees, fruit trees, hazardous trees, trees near power lines, etc. – require specialized equipment and skills.

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spread of pathogens through the tree (compartmentalization).

Unfortunately, this predisposing effect is often hard to detect: first, it usually takes some time for an energy-starved tree to become afflicted with a disease or insects (and by then the pruning has long been forgotten). Second, the afflicted part of the tree is often distant to the pruned area and so the connection between pruning and the problem remains hidden (see photo). In extreme cases, the severely pruned trees (often an attempt to reduce their size) often are the first to develop insect or disease problems. In the words of the late Dr. Shigo (1989, p. 143): "You cannot prune a big tree to make it a small healthy tree no matter how you try."

Timing

Research results are somewhat conflicting regarding the best time of year to prune. In general, it is not advisable to prune trees at "times of low energy reserves, when a tree is stressed, and when the soil is uncharacteristically dry or flooded" (Gilman, 2012, p.128). In addition, remember to check for specific insects and diseases that could affect the tree you are about to prune, and ensure that you will not be making the tree "more attractive" to those pests (e.g., prune elms in winter, when the DED vector beetles are inactive.)

The removal of large branches in mature trees may predispose trees to insect and disease problems. We can avoid having to remove large branches, by pruning more often to remove small branches before they grow, and thus guide the tree to its optimal form and condition without having to incur the penalty of losing too many leaves and too much stored energy. In three simple steps:

(1) Prune small – prune often !

... and limit the total amount of branches removed.

(2) Prune well !

...by making correct cuts; with clean tools, timed to avoid insects and diseases; and disposing of pruned material appropriately.

(3) Respect the natural form !

...by remembering that we cannot "make" a round-headed redwood by pruning or a pole-like coast live oak without severely stressing the tree.

References:

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- Shigo, A. 1989. *Tree Pruning, a Worldwide Photo Guide for the Proper Pruning of Trees*, 143.
- Gilman, E.F. 2012. *Illustrated Guide to Pruning*, Third Edition. Delmar Publishers, Albany, NY., 128.
- Igor Laćan, *Environmental Horticulture Advisor, UCCE San Mateo – San Francisco Bay Area*, ilacan@ucanr.edu

Ask the Expert!

Q In the article on oils as pesticides in the May issue of the Green Bulletin, the author noted that oils were often the most efficacious fungicides against powdery mildew, especially in reducing existing infections. What types of oils are best to use?

A UC Davis Plant Pathologist Doug Gubler notes that the best oils to use are JMS Stylet Oil and PureSpray Green because of their safety for treated plants. Other horticultural oils such as Sunspray Ultra-Fine Spray Oil also kill powdery mildew fungi but have higher unsulfonated residues and thus may be more prone to causing phytotoxicity under some circumstances. Plant-based oils such as neem oil or jojoba oil (Eco E-rase) can also be used against powdery mildew. Note that resistant varieties and cultural practices are often the best approach for managing disease on landscape ornamentals.

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WHAT IS IPM? Integrated Pest Management (IPM) programs focus on long-term prevention of pests or their damage through a combination of techniques including resistant plant varieties, biological control, physical or mechanical control, and modification of gardening and home maintenance practices to reduce conditions favorable for pests. Pesticides are part of IPM programs but are used only when needed. Products are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.