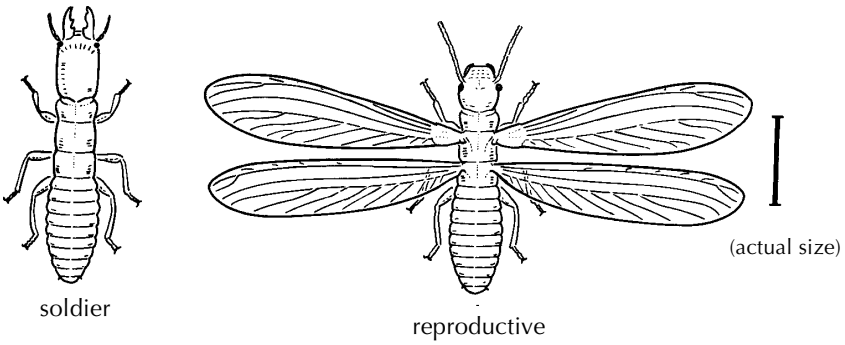
DRYWOOD TERMITES

Integrated Pest Management in the Home

Drywood termites, *Incisitermes minor*, are California's second most important termite pest after the western subterranean termite. They are native insects that have been here millions of years, mostly attacking trees along river washes and arroyos. In California they have an uneven geographic distribution: they are most prevalent in southern California and the Central Valley but also can be found infesting wood along the coast and Bay areas south of San Francisco and in the southern California desert. For more information on the biology and distinguishing characteristics of this and other termite species common in California, see UC/DANR Publication 7415, *Pest Notes: Termites.*

This publication is intended to provide homeowners with sufficient background information so that they can better discuss treatment options with pest control professionals; it is not intended as a treatment guide.



Western Drywood Termite

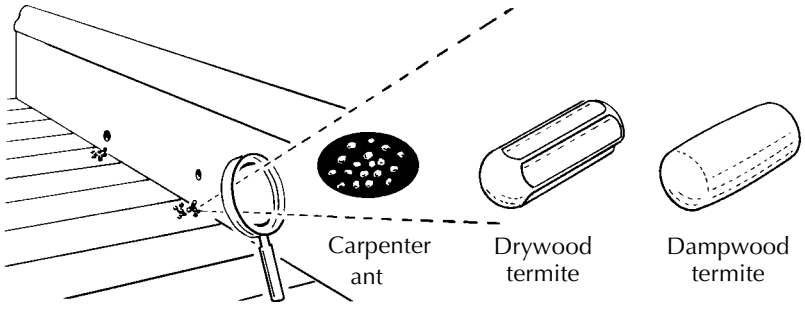


FIGURE 1. The fecal pellets produced by drywood termites are elongate with rounded ends and have six flattened or roundly depressed surfaces separated by six longitudinal ridges.

DETECTION

Drywood termites are secretive insects and are difficult to detect. They live deep inside wood and, except during periods when they swarm or when repair work is being done on infested homes, they are seldom seen. Colonies are small (usually fewer than 1,000 individuals), can be widely dispersed, and take years to mature. While a homeowner may initially detect the presence of termites when they swarm or if fecal pellets are discovered, inspecting for drywood termites and determining the extent of an infestation require experience.

Of the 1.5 million structural pest inspections conducted annually in California, many are for drywood termites. Most inspections are based on visual searches; other detection methods include the use of dogs, odor detectors, and vibration-sensitive devices. Except for vibration devices, these detection methods are still considered experimental because adequate research has not been conducted on their effectiveness. Unfortunately, vibration-sensitive devices are not commercially available, so visual inspections are the mainstay of the pest control industry.

During an inspection for drywood termites, inspectors look for termite fecal pellets and kickout holes (Fig. 1), which are small holes the size of BB shot through which termites push their fecal pellets out of the wood. Fecal pellets, hexagonal in shape, are diagnostic for drywood termites. However, whether the infestation is currently active or what the extent of the infestation is cannot be determined from pellets alone. To determine if the infestation is active, clean up the pellets around a kickout hole

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and check a few days later to see if new pellets have appeared. Take into consideration when checking that building vibrations/movements may cause some pellets to appear. If an active infestation of drywood termites is found in your structure, you need to have it treated. Because of the difficulty in detecting drywood termites and determining the extent of their damage, do-it-yourself treatments are not recommended; consult a pest control professional.

WHOLE-STRUCTURE VERSUS LOCALIZED OR SPOT TREATMENTS

All drywood termite control methods can be categorized as either whole-structure or localized. A whole-structure treatment is defined as the simultaneous treatment of all infestations, accessible and inaccessible, in a structure. A localized or spot treatment is more restrictive, often applied to a single board or small group of boards. Homeowners are advised to know the distinction between whole-structure and spot treatments when deciding which method to select because all treatment methods are not equivalent. Each year, several hundred thousand treatments are directed against drywood termites in California; of these about 70% are spot treatments with chemicals, 20% are whole-structure treatments with fumigants, and 10% are nonchemical methods.

ELIMINATING EXISTING INFESTATIONS

Whole-structure treatments have an advantage over spot treatments in that they are detection independent. This means whole-structure treatments, if applied properly, can eliminate all infestations, even hidden ones. With the unreliability of current detection methods, there is always some doubt as to the extent of drywood termite colony boundaries within homes. Consequently one can never be sure that all infestations have been treated when applying spot treatments. The strengths and limitations of whole-structure and spot/localized treatments are outlined in Table 1.

Whole-Structure Treatment

Fumigants (methyl bromide and sulfuryl fluoride) treat all infestations simultaneously, and have high levels of efficacy, often 100% if correctly applied. Major issues to consider with the use of fumigants include the difficulty of installing tarpaulins, the difficulty in determining the proper dosage, the need to protectively bag food items, and the lack of residual control. Residual control means long-term protection from drywood termite attack, often for several years or more. (Generally, only chemicals added to or onto wood provide residual control.) Vacating structures 1 to 2 days for treatment and ventila-

TABLE 1. Summary of Drywood Termite Control Options

Treatment	Efficacy	Strengths	Considerations/Limitations	Damage to Structure
EXISTING INFESTATIONS				
Whole-Structure				
Fumigants	> 99%	hidden sites treated	must leave house, no residual	possible residual odor with methyl bromide; gas pilots must be extinguished before treatment; possible damage to roof if walked on
Heat	> 95%	hidden sites treated	no residual, heat sinks[a]	possible damage to some household items
Localized or Spot Treatments				
Chemical				
Chemical liquids & dusts	[b]	long-term	detection accuracy, residuals present	yes, if drill holes used
Liquid nitrogen	> 90%	benign material	detection accuracy, no residual	yes, minor drill holes
Nonchemical				
Biological Control	[b]	no chemicals	research needed	[c]
Electrocution	80-99%[a]	portable	detection accuracy, many disclaimers	yes, if drill holes used
Heat	> 95%[a]	semi-portable	heat sinks[a]	maybe[c]
Microwaves	≈ 90%[a]	semi-portable	detection accuracy, heat sinks[a]	maybe[c]
PREVENTIVE				
Chemical liquids & dusts	[b]	long-term	chemical residual	yes, if drill holes used
Pressure-treated wood	[b]	long-term	chemical residual, discoloration	no
Nonchemical				
Barriers (screens/paint)	[b]	long-term	barriers degrade & can be breached	no
Resistant woods	[b]	long-term	costly, availability	no

[a] additional research needed
[b] little or no published efficacy data
[c] little or no published data on structural safety

tion, and the possible damage to roofs caused by dragging tarpaulins or walking are additional considerations with fumigant use.

Heat is a nonchemical option for whole-structure treatments. The treatment process involves heating all wood in the structure to at least 124°F and holding this temperature for at least 30 minutes. The benefit of heat treatment is the ability to treat the entire structure without the use of chemicals and the relatively short period of time the structure must be vacated (hours instead of days, as with the use of fumigants). An additional advantage is that portions of large structures can be treated separately, which is very useful in apartments and condominiums. The major drawback to using heat is heat sinks, which are areas within the structure that are difficult to heat, such as wood on concrete. Other issues to consider include the possible damage to sensitive items in homes, and like fumigants, heat treatments have no residual control. Of course, preventive chemicals can be added to areas treated with fumigants or heat for long-term protection (see preventive section in Table 1). As more powerful and efficient heaters are developed, larger homes can be efficiently treated with heat.

Localized or Spot Treatments

There are many localized/spot treatment methods available (Table 1) that include both chemical and nonchemical options. The **chemical options** include liquid organophosphates and pyrethroids, borate and desiccant (silica gel) dusts, and liquid nitrogen. For the liquid and dust insecticides to be effective, they must be touched or ingested by termites. Liquid nitrogen is different from the other spot treatment methods in that its mode-of-action is thermal; it causes a sudden drop in temperature, which kills the termites. Laboratory studies have shown that 5 minutes at -5°F kills drywood termites.

Efficacy information is lacking for most chemical spot treatments for drywood termites. In recent experiments, however, surface or gallery injections of aqueous disodium octaborate tetrahydrate (Timbor) and gallery injections of chlorpyrifos did not effectively control a closely related species of drywood termites, *Incisitermes synderi*. For liquid nitrogen, dosages that exceed 30 pounds per enclosed wall space between 2 x 4s achieve high levels of effectiveness. Although most chemicals give long-term control, liquid nitrogen has no residual activity when used alone. Minor damage to the structure occurs from the holes drilled for spot treatments of chemicals and for liquid nitrogen insertion. For all spot treatments of chemicals, including liquid nitrogen, it is critical that all infestations in a structure are detected so that they all receive treatment.

There are four **nonchemical options** for drywood termite control with spot or localized application (Table 1), including *heat*, which is used for both spot and whole-structure treatments. The advantages and disadvantages discussed for heat as a whole-structure treatment also apply to spot treatments. *Microwave* devices are also available for drywood termite control. Microwaves kill termites by causing fluids inside their cells to boil, which destroys the cell membranes; in short, the termites are cooked inside the wood. There are a number of firms now offering microwave treatments. One advantage of microwaves is their relative portability; another advantage is that they are nonchemical. When using microwaves, however, detection accuracy is critical to success. Both microwaves or heat treatments may damage the surface or interior of wood boards, depending on the power of the device. (The wattages or power of microwave or heating devices may vary from several hundred to more than 10,000 watts.) As with heat treatments, it may be difficult to heat areas with heat sinks to high enough temperatures with microwaves for effective control.

High voltage electricity, or *electrocution*, is another nonchemical option for controlling drywood termites. The device currently marketed uses high voltage (90,000 volts) but low current (< 0.5 amps). The exact means of killing termites with this method is still unclear and needs more research. The advantage of electrocution is that the equipment is portable. The limitations include detection accuracy and the possible reduced efficacy from the interfering actions of common building materials, for example metal, concrete, and glass. If drill holes are used to enhance the flow of current into wood, minor damage occurs to wall coverings, walls, and structural wood members.

Wood replacement is another remedial treatment option. However, similar to the other spot treatments, its effectiveness is highly dependent on detection accuracy and extent and location of the infestation, and it may be expensive to accomplish.

There is little information on biological control of drywood termites. Biological control is the use of other life forms (e.g., insects, nematodes, or microbes) to control pest insects. Although predators, parasites, and pathogens have been shown to control other insect pests, their efficacy for drywood termite control has not been explored.

LONG-TERM PREVENTIVE TREATMENTS

Although several materials and methods have been suggested for long-lasting prevention against infestation, there is little data on their effectiveness against drywood termites. For example, studies with chlorinated hydrocarbons, organophosphates, borates, and inorganic arsenicals suggest that they provide long-term prevention of infestation, but these studies were conducted on termite species other than drywood termites. Drawbacks with some chemical preventive treatments include damage from drill holes and unsightly appearance from dusts. The effectiveness of pressure-treated wood (chemically treated wood that is brown or green in color) for drywood termite prevention needs additional research. Wood painted

with one or two coats of creosote or two coats of oil-base enamel or shellac was not penetrated by drywood termites. A single coat of latex enamel or urethane varnish provided no protection, whereas a single coat of epoxy enamel gave some protection (60%). Double coats of these materials increased their effectiveness (30% for latex enamel, 70% for urethane varnish, and 90% for epoxy enamel).

A common strategy is to mix nonchemical and chemical treatments to ensure that termites are not able to colonize over the long-term. Nonchemical long-term preventive methods include physical barriers, such as metal screens, resistant woods (see UC/DANR Publication 7415, *Pest Notes: Termites*), and paints. Once again, there are few studies that demonstrate the efficacy of mixed treatments or nonchemical treatments directed against drywood termites.

DID I MAKE THE RIGHT CHOICE?

When treatment is being considered for drywood termites, consider whether the whole structure is to be treated or just localized areas. With localized/spot treatment methods it is more difficult to ensure complete control because of the uncertainty in determining the extent of the drywood termite infestation. There also appears to be considerable variation in effectiveness of various techniques from applicator to applicator. Read your guarantee carefully; you may wish to consider an annual service. Also important is company performance. There are thousands of pest control companies in the state. They don't all have the same services or performance. Obtain at least three vendor bids before you decide. Check the performance of the vendor by asking for client referrals and check the status of their business license and consumer complaints with the California Department of Consumer Affairs, Structural Pest Control Board, in Sacramento.

In summary, research conducted thus far indicates most drywood termite control methods are at least 90% effective if infestations are adequately detected. The publication by Lewis and Haverty listed in the References gives details of research studies evaluating these techniques. For added information on safety to humans and structures, request the Material Safety Data Sheets for chemicals or equivalent information for nonchemical control methods from the pest control company.

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For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits and/or vegetables ready to be picked.

Dispose of empty containers carefully. Follow label instructions for disposal. Never reuse the containers. Make sure empty containers are not accessible to children or animals. Never dispose of containers where they may contaminate water supplies or natural waterways. Do not pour down sink or toilet. Consult your county agricultural commissioner for correct ways of disposing of excess pesticides. Never burn pesticide containers.

PHYTOTOXICITY: Certain chemicals may cause plant injury if used at the wrong stage of plant development or when temperatures are too high. Injury may also result from excessive amounts or the wrong formulation or from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, diluents, and solvents, can cause plant injury. Since formulations are often changed by manufacturers, it is possible that plant injury may occur even though no injury was noted in previous seasons.