Control of Drywood Termites

infestation or reinfestation after eradication prevented by treatment with inert dusts nontoxic to humans or animals

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Drywood termites—about as important in southern California as subterranean termites—have spread north to the San Francisco Bay region and Sacramento.

The drywood termite may enter a building through the attic vents, under or directly through shingles, under the eaves, or through the foundation vents. Although most often found in the attic or in window frames, they may be found in the wood substructure of the building. Their presence is indicated by piles of straw-colored to reddish-brown fecal pellets, appearing somewhat like coarse sand, which drop down from chinks or kick-out holes in the infested wood. Flights of the winged reproductives on days of high temperatures and bright sunshine during the fall months, particularly October, sometimes are the first sign of drywood termite infestation to come to the attention of the building owner.

Control of the drywood termite has been obtained by one or the other of two methods. When infestations are accessible, and reasonably localized, the drill-and-treat method can be used. The pest control operator probes for the galleries or tunnels inhabited by the termites and injects either insecticide dusts or liquid fumigants. For more extensive or inaccessible infestations, the entire building may be fumigated with methyl bromide gas.

Drywood termites should not be confused with subterranean termites. The latter, when infesting buildings, require a connection with the damp soil, so as to replenish the water lost from their bodies in the dry wood. If the wood they infest rests upon a concrete foundation, subterranean termites must construct shelter tubes over the concrete so they are able to crawl back periodically to the earth and replenish their body moisture. Also, the shelter tubes protect the termites from natural enemies, particularly ants. Drywood termites do not enter the earth and do not construct shelter tubes.

Control with Woodtreat TC

An emulsion of 10% pentachlorophenol in a light oil—Woodtreat TC—brushed onto the surface of the wood with an ordinary paint brush has long been used to prevent damage to a building's substructure by subterranean termites, but its use against drywood termites in homes is believed to be new. Yet the emulsion may be used for actual eradication of drywood termites—rather than prevention of damage—because the termite colony is confined in a limited area within the wood. Painting the emulsion over the surface of the infested area enables the toxicant to penetrate to the galleries inhabited by the termites and cause the extermination of the entire colony. The penetration of the toxic oil to the galleries is aided by the fact that the termites tend to burrow as close to the surface as possible without actually breaking through to the outside. Therefore, some sections of the gallery are separated from the outside by only a very thin layer of wood, which is easily penetrated by the oil.

An emulsion is used because it may be applied in a heavy layer. As the emulsion breaks, the toxic oil is slowly released and penetrates deeply into the wood. A coating ¼″–½″ thick gives penetration equal to 20 brush coats of unemulsified oil.

The juncture of two wood members—such as a ceiling joist and plate or a rafter and sheathing—will hold a large quantity of emulsion in place and the oil will penetrate between the wood members. If a cut end is reached, the oil will penetrate with the grain of the wood for distances as great as 2′.

The attics of 13 dwellings, the substructure of four, and two garages were treated with the emulsion. Infested areas in the structures varied from two or three to a dozen or more and were sometimes found throughout the entire attic, substructure, or garage area. From three quarters to two gallons of emulsion were used, per structure, depending on how widespread the infestation was.

In the attics and substructures, newspapers were laid down to catch the pellets that might fall after treatment, indicating incomplete control. The treated areas were examined from one to two months after treatment.

In four of the 13 attics and in both garages, pellets had fallen in appreciable amounts by the time of the first inspection after treatment; the result of incomplete survey of the infested areas before the treatment was applied. More emulsion

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Silica aerogel being blown throughout the attic of a residence from the crawl hole area.

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was applied to the limited areas missed or inadequately treated at the time of the first application. In no instance was a fresh fall of pellets found after the second application.

The brushing method has the advantages of being applied more rapidly and is more foolproof than the drill-and-treat method because the galleries are sometimes difficult to detect. Also, sometimes they are stopped up and the dust may not follow the entire course of the gallery. With the brushing method the toxicant can be applied externally far beyond the suspected area of infestation, because the time and expense of doing so are negligible.

Compared with methyl bromide fumigation of an entire dwelling, the insecticide brushing method is more rapid, less expensive, and causes no inconvenience to the occupants. Also, incomplete results or reinfestations can be quickly and inexpensively rectified by second applications of the emulsion, whereas a second fumigation would be almost out of the question because of the great expense.

Although the pentachlorophenol emulsion has often been applied without the use of gloves or masks, both chemical-resistant gloves and a mask designed to remove organic vapors should be worn by the operator during application. If the skin is accidentally contaminated, the material should be removed by soap and water.

Silica Aerogels

The incidence of drywood termite infestation in southern California is so high that reinfestation, even within a year after treatment, is not uncommon. Therefore, a preventive treatment—applied in conjunction with or immediately after the control treatment—has been needed. A clue to such a treatment was offered by the observation that certain inert dust diluents are more effective against drywood termites than existing formulations of insecticide dusts. Moreover, the effectiveness of the diluents does not appear to diminish from long periods of exposure to air and high temperature. The inert dusts kill the insects by physical rather than chemical means because they adsorb the thin protective layer of wax off the bodies of the termites, which causes death by rapid desiccation.

Certain sorptive clays were found to be among the most effective of the existing insecticide diluents. One of the diluents—Olancha Clay—was registered for use as a termite preventive under the name Olancha Tox. This material is being applied in attics at the rate of five pounds to 1,000 square feet of area.

Comparison of Dri-Die 67 with Olancha Tox and 5% Chlordane as Attic Dusts for the Prevention of Drywood Termites

Material	Pounds per 1000 sq. ft.	Date treated	Date exposed to termites	Knockdown (hours)	Mortality (hours)
Dri-Die 67	1	5-22-58	5-23-58	1.5	4.8
Olancha Tox	6.4	5-22-58	5-23-58	6.0	12.5
Dri-Die 67	1	9-9-58	9-10-58	3.5	14.3
Chlordane	2	9-9-58	9-10-58	35.0	63.0
Dri-Die 67	2	9-9-58	9-10-58	1.7	4.7
Chlordane	4	9-9-58	9-10-58	8.5	24.0
Dri-Die 67*	2	9-9-58	10-14-58	1.9	3.9
Chlordane*	4	9-9-58	10-14-58	24.3	33.3

* The blocks of wood from the previous treatment were placed back in the attic and termites were placed on them again 35 days after treatment.

In tests, sorptive dusts were blown throughout an attic from the crawl hole, by the use of an electric blower. The operator may be entirely inside the attic, or with only his head and shoulders above the crawl hole, which permits rapid and convenient withdrawal. Because air will move upward through the crawl hole, it is not necessary to close the opening during the brief period required to apply the dust. The dust should be blown under the house as well as throughout the attic, because drywood termites often infest wood members of the substructure.

Research was continued to find materials that might prevent termite infestation with even lower dosages. For comparative tests, three blocks of wood were hung in various parts of an attic and taken down after exposure to the dust. They were placed in 100 milliliter beakers and either 10 termite alates—winged—or 10 full-grown nymphs were placed in each of the three beakers to determine the period required for 100% knockdown of the termites and 100% mortality. On the average, the period required for knockdown or death of the alates was only about 70% as great as that of the nymphs.

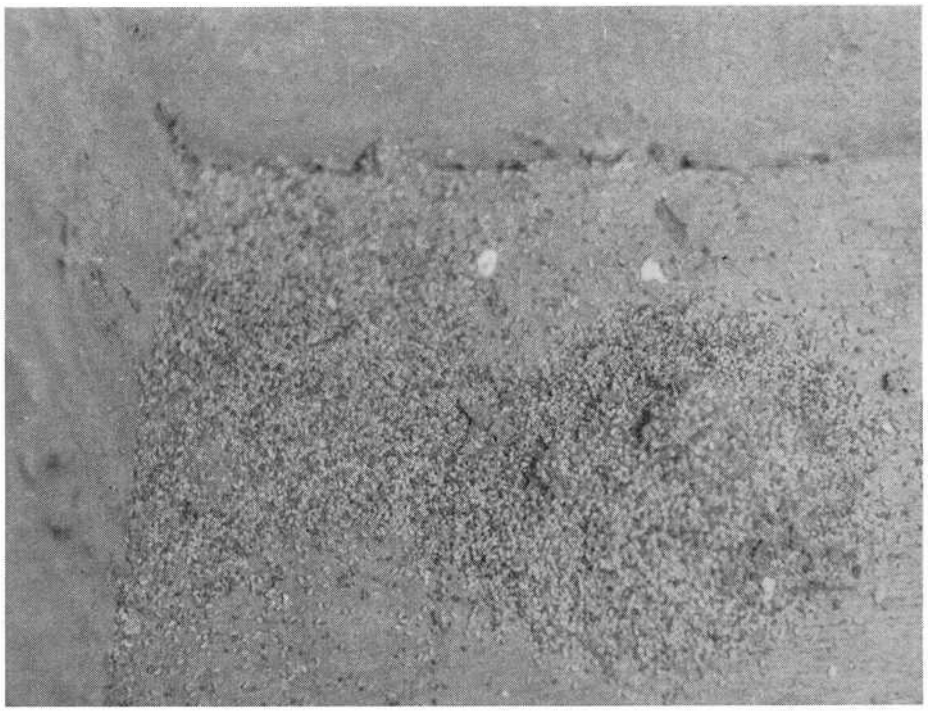
Experiments with dust desiccants have been made in 18 residences, including the 13 that were first treated with the pentachlorophenol emulsion and five that were first fumigated with methyl bromide. In no case did the termites do any feeding on the dusted wood.

Soon after the experiments were begun it was found that silica aerogels killed termites more rapidly than clay dusts, even at a much lower dosage.

Silica aerogels are amorphous and in extremely small particles that are prepared by the reaction of sodium silicate with sulfuric acid. A hydrogel is formed and when dried, air takes the place of the water without changing the structure of the silica. The dry material can be ground to particles of extremely small size. For example, one brand has particles of an average size of 3.5 microns, but they themselves are porous and have great sorptive ability.

Silica aerogels have been used pri-

Fecal pellets of drywood termites on a ceiling plate at the base of a stud.



marily as flatting agents in the paint industry. For certain industrial reasons it is desirable to impregnate them with small percentages of certain inorganic fluorides. It happens that the fluorides have the effect of giving them a positive charge, thus increasing their depositing properties. In addition, insecticidal effectiveness has been increased greatly by the monomolecular layer of fluoride. The fluorides do not detract from the ability of the silica aerogel particles to adsorb wax. The water-soluble fluorides are thus brought into contact with water-containing tissues in which they can be dissolved and exert their toxic effect.

The impregnated materials were found to be so superior to the unimpregnated products that they were henceforth used exclusively in experimental work, not only with termites, but with a number of other insect and mite pests. With the impregnated silica aerogels it makes little difference how much moisture there is in the atmosphere, up to and including 100% relative humidity. If the dust deposits are wet and later dried, they are less effective because they are not picked up as readily by the insects.

Three typical experiments showed the superiority of the impregnated silica aerogels. In one test a fluoride-impregnated silica aerogel—Dri-Die 67—was used at one pound per 1,000 square feet of attic space and was compared with 6.4 pounds of Olancha Tox. In the second test the Dri-Die 67 was used at one pound per 1,000 square feet and 5% chlordane was used at two pounds. In the third test, Dri-Die 67 was used at two pounds and 5% chlordane at four pounds to 1,000 square feet of attic space. The 5% chlordane dust was selected because it has been the most common of the insecticides used for attic dusting against drywood termites since 1956.

In the third test, the treated blocks of wood were placed back in the attic and termites were again placed on the same blocks 35 days after treatment. The results of the experiment are shown in the table on page 8. Dri-Die 67 was greatly superior in its immediate effectiveness to Olancha Clay and 5% chlordane dust, even when used at lower dosages. Moreover, the chlordane dust—as do other insecticides—rapidly decomposes at the high temperatures encountered in an attic in the fall, the period when the alates fly.

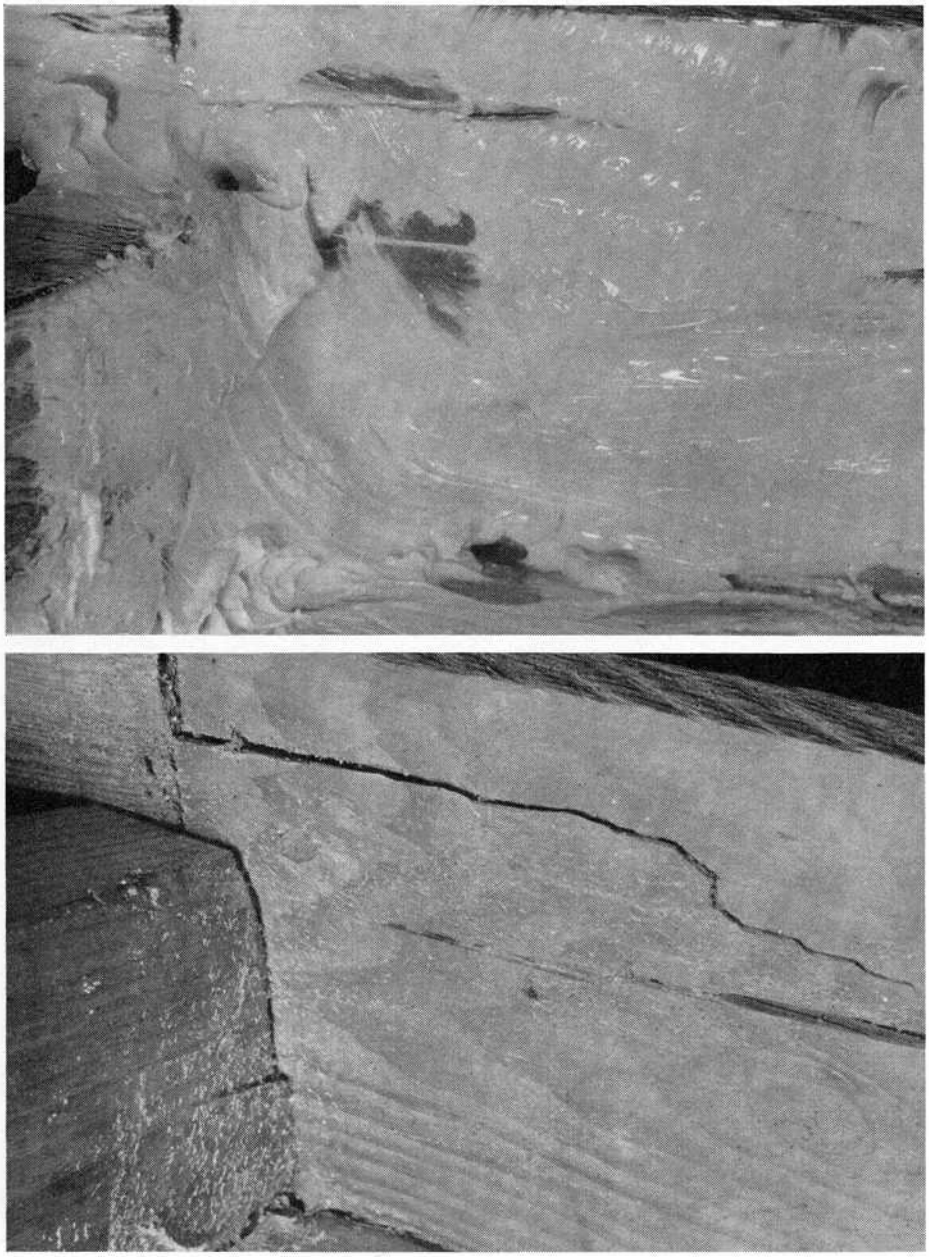
The day following treatment, the ratio of the period required for 100% knockdown—and also for 100% mortality—from Dri-Die 67 and chlordane was 1:5.0. When comparisons were made 35 days after treatment the ratios had increased to 1:12.8 for 100% knockdown and 1:8.5 for 100% mortality. Probably within the 35-day period the 5% chlordane dust had reached the degree of effectiveness that might be expected of its diluent alone, which is pyrophyllite.

The superiority of Dri-Die 67 as a preventive—in this test—is typical of eight experiments in which Dri-Die 67 was compared with other dusts, including other types of aerogel.

In other experiments, Dri-Die 67 was effective also in the control of German, oriental, and brown-banded cockroaches. In addition, it shows promise in the control of fleas on pets, two-spotted mites on roses, and of bees and wasps colonizing in attics and walls of houses.

Experiments on laboratory animals and the experience of workers handling amorphous silica aerogels indicate they are not hazardous to the health of those who may apply the dusts or to the occupants of treated premises. Nevertheless, silica aerogels may be irritating when inhaled and a dust respirator should be worn by those who apply the dust—a desirable procedure when handling any kind of dust.

Emulsion of 10% pentachlorophenol and light oil applied to wood in an attic to control drywood termites. Above, immediately after application, showing the thick layer that may be applied by the brushing method; below, the same area a month later, showing the scanty residue of crystals remaining on surface.



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The biology and control of subterranean termites are discussed in detail in Termite Control, *Circular No. 469, available by addressing a request to Agricultural Publications, 22 Giannini Hall, University of California, Berkeley 4, California.*