LOCAL HOUSING AUTHORITY MANAGEMENT HANDBOOK

PART V
MAINTENANCE

SECTION 2- TERMITE CONTROL

HOUSING AND HOME FINANCE AGENCY
PUBLIC HOUSING ADMINISTRATION

An up-to-date list of all Local Housing Authority Management Handbook Sections is provided in Low-Rent Housing Manual Section 100.2, Supplement 1, Exhibit 7.

TERMITE CONTROL

CHAPTER 1 - SUBTERRANEAN TERMITES

CHAPTER 2 - NONSUBTERRANEAN TERMITES

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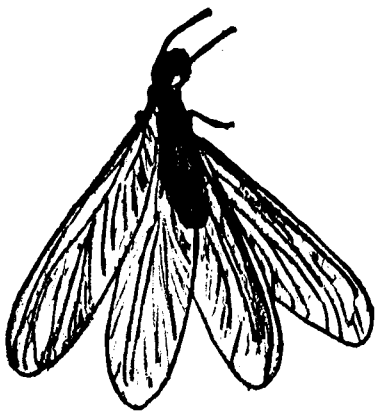
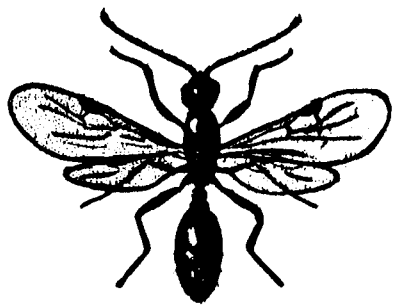


TERMITE



ANT

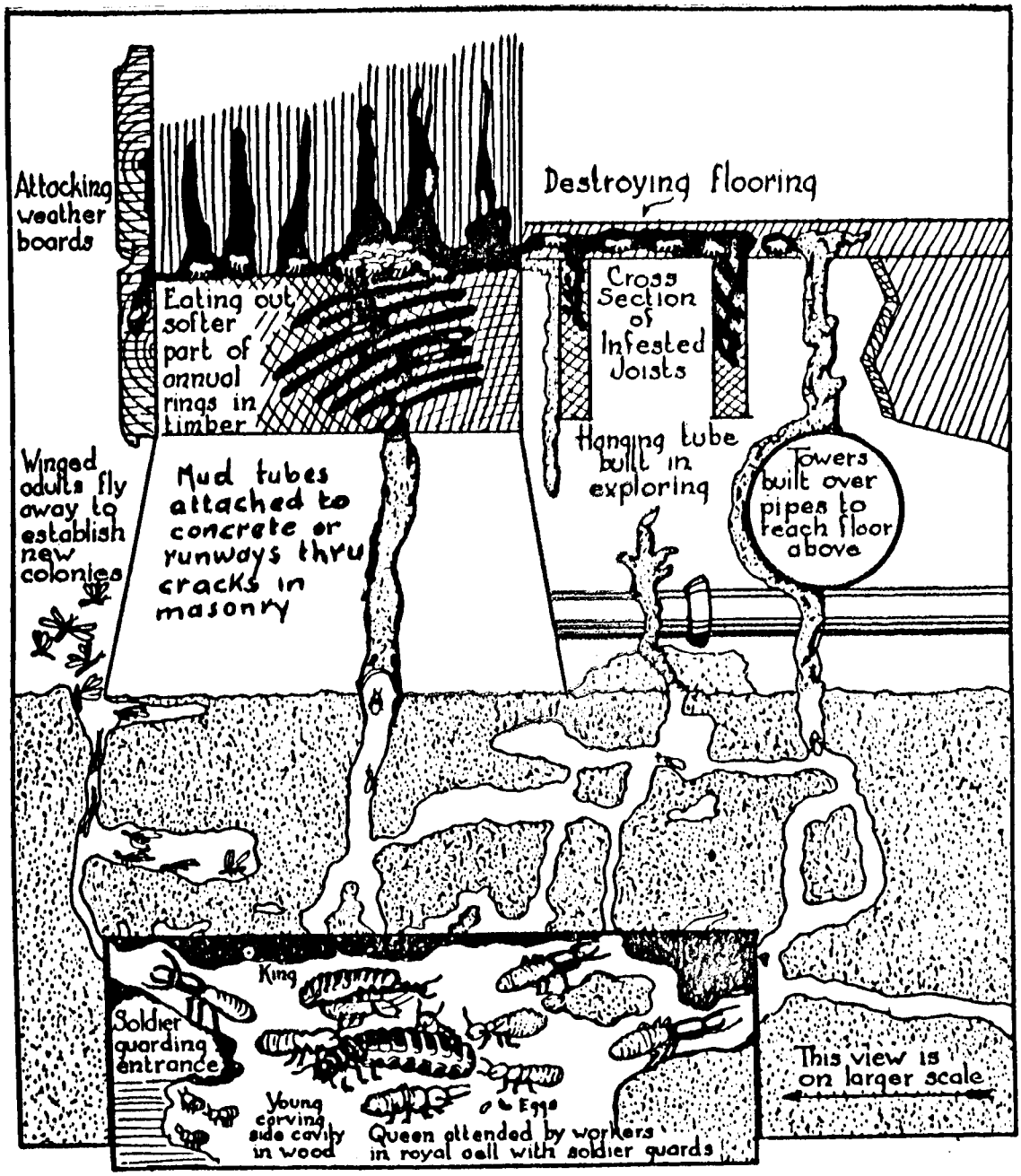
Photographs - Courtesy of USDA

Photographs show difference between the termite and the ant during the swarming stage.

The termite shown on the left is magnified approximately five times. Note the body has a thick waistline and that the front and back wings are practically the same length.

The ant shown on the right is of no particular type and/or magnification, but is to show the difference between the ant and the termite.

Note the waistline is constricted or "pinched in," and the rear pair of wings are considerably smaller than the front wings.



COMPOSITION AND WORKINGS OF A TERMITE COLONY

This drawing shows how the termites live, their tunnels and tubes, their ability to burrow through cracks in concrete and masonry, attach mud tubes to concrete surfaces, and the damage to wood framing, flooring, siding, and trim in buildings.

TERMITE CONTROL

CHAPTER 1 - SUBTERRANEAN TERMITES

1. INTRODUCTION

Subterranean or ground-nesting termites are worldwide in distribution. They are small, yet they seriously damage the wood in any structure. The expenditures for making repairs and applying control measures total many millions of dollars annually. Termites are capable of causing structural damage in any part of the country. Because of this, it is recommended that careful inspection for termites be a part of every preventative maintenance program of each Local Authority. We sometimes lose sight of the fact that prevention is cheap and that cure can be extremely expensive, which is specifically applicable to termite conditions.

Originally existing only in the forests as scavengers of timber, termites were forced to migrate to buildings for food and shelter because of the clearing of woodlands for cultivation and building sites. The trouble is augmented by heated dwellings and insufficient drainage and ventilation in crawl spaces, thus maintaining the humid condition required by these subterranean termites. An additional inducement to termite infestation is the practice of placing untreated wood in direct contact with the ground surfaces or on masonry foundation walls with inadequate protection or space above the soil.

2. CHARACTERISTICS AND RECOGNITION

All too frequently the first knowledge a project manager has that his project is infested with termites is when a tenant reports "flying ants." Such reporting is good, and tenants should be encouraged to report swarms of any flying insects. If prompt inspection is made, it may result in eliminating costly future repairs. Swarming usually occurs in the first warm days of spring or on warm days in early winter. In heated buildings the winged termite may emerge much earlier. Generally, the tenant does not distinguish between termites and flying ants and reports either as "flying ants." Flying ants can be distinguished easily from swarming termites by persons who are familiar with their distinguishing characteristics. The ants have sectional bodies with threadlike waistlines and two pairs of unequal-sized wings which extend only about one-half their length beyond the body and which they retain during the swarming period. Flying ants are not destructive and may be ignored. Swarming termites have no distinct waistline and two pairs of whitish opaque wings of equal size that extend about two-thirds their length beyond the body.

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Termites are social insects, live in colonies, and have a well-developed caste system consisting of a king, queen, soldiers, and workers. The termites seen flying are the adult reproductive species which have left the parent colony and are endeavoring to establish new ones. Flights are generally of short duration, for as soon as they find wood in contact with the moist ground, a pair of termites will shed their wings, dig in, and proceed to establish the colony. However, for termites remaining in buildings, the wings are shed soon after emerging from the colony to facilitate their returning to the ground through crevices in the floor or wall. In addition, there are the secondary and tertiary reproductives which are without wings and merely spread out in the ground. In well-developed colonies, there may be from 35 to 100 who reproduce in addition to the primary pair.

Termites lead a secluded life, differing from their nearest relative, the cockroach, in that they are found concealed within the woodwork of buildings, which they consume. Subterranean termites are dependent upon (1) a constant source of moisture; and (2) "cellulose," the main constituent of wood and their principal form of food. They eat and digest the soft portion of wood and leave the inside of their galleries covered with brownish specks of excrement and, frequently, earth.

As additional broods of termites are hatched in the colony, the workers take over the duties of providing food for the king and queen, thus leaving the queen to devote all of her time to enlarging the colony. The sterile adult soldiers and workers are wingless, grayish-white, and similar in appearance, except that the soldiers have a longer brownish head and a pair of longer and stronger mandibles, or jaws. The workers, although somewhat smaller, are the most numerous and do all the work of caring for the colony. On opening a piece of wood that is infested with subterranean termites, one sees a crowd of small wormlike animals running around looking a bit like kernels of hulled rice. Those are the workers, soldiers, and reproductives.

Subterranean termite colonies occur in soil and develop and thrive where wood is easily reached on the ground. Once established the workers can reach more distant wood through earthen shelter tubes which they construct over the surface of any building material. These tubes which protect them from the drying effect of the atmosphere are easy to find if on exterior surfaces. However, there may be no external evidence of their presence if they are constructed between bricks, hollow tile, concrete blocks, or even in small cracks in concrete slabs. When feeding in wood, the pearly-white worker termites make galleries that follow the grain. These galleries seldom show on the wood surface. They may be found by removing weatherboarding or trim

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boards or by probing the wood members with an ice pick or a knife in places susceptible to attack. Striking infested timbers with a hammer or other object will produce a hollow or dead sound. Termites do not push out sawdustlike material from their galleries. Since they feed on the wood, their galleries are free of powdered wood thus distinguishing their work from that of powder-post beetles and carpenter ants.

On occasion, termites have been known to injure living plants, but the greatest economic loss is caused by their activities in the woodwork of buildings.

3. HAZARDS OF INFESTATION

The hazards of termite infestation are greatest beneath buildings having (1) a concrete slab on the ground; (2) a crawl space with inadequate clearance, ventilation, and drainage; (3) a basement with enclosed porches, sun parlors, and terraces, where filled earth comes very close to the building timbers. In slab-on-ground construction and in basementless buildings, the hazard is apt to be greater along the inside of the foundation, while in buildings with basements the opposite is apt to be true.

4. INSPECTION

If termites are working in a building, it is most important that they be discovered and checked. The damage they create in their attack on wooden structures is frequently not discovered until replacement is necessary. It is, therefore, recommended that all buildings be thoroughly inspected at least once a year, as follows:

a. Foundation Walls

Examine the interior and exterior surfaces of foundation walls for mud tubes built by the termites and used for passage between the soil and wood or over and around obstructions, such as termite shields. These shelter tubes or covered passageways vary in width from 1/8 inch to 1/2 inch or more. If a small section of the tube is broken out, the termites from the upper portion of the tube may be observed trying to return to the soil. There is little chance of the termites in the lower portion of the tube exposing themselves, other than while repairing the broken tube or extending it in another direction.

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b. Damaged Timbers

The fact that no tubes are found does not eliminate the possible presence of termites. Entry directly to timbers may have been made through loose joints or cracks in the masonry. This condition can be detected by testing each of the timbers with a sharp instrument, such as an ice pick. If termite damage has occurred, the pick will easily enter the wood which, when opened, will expose some of the burrows and extensive tunneling along the grain of the wood. To find the extent of the damage, the wood framing should be tested in all directions from this point. By using this method, the point of entry can often be determined. It is possible also to test the timbers by tapping with a hammer since a hollow sound may be detected if termites are working within.

Both the ice pick and hammer test are also used to detect so-called "dry rot" caused by fungi. If "dry rot" alone is present the wood will be soft and spongy but no tunneling will be present.

5. PRINCIPLE OF CONTROL

In attempting to control termites in a building, the main thing to remember is to break the contact between the termite colony in the soil and the woodwork in the building. This can be done (1) by making the necessary changes in structure to block the passageways from soil to wood, and removing all wood supports, formboards, debris, etc., from the ground; (2) by chemically treating the soil; or (3) by using a combination of these methods.

6. CHEMICALS AND THEIR PREPARATION

The four chemicals recommended are for water emulsion preparation. Unlike oil solutions which are also effective, they will not injure plants when used along exterior foundation walls nor will they creep up walls and damage floors, as oil may, when applied along the interior of foundations. The concentrations recommended allow a margin of safety and provide protection for several years. For termite control south of the 39th parallel of latitude, it is recommended that the specified proportions of chemical concentrate be doubled.

a. Aldrin - One-half Percent Emulsion

This is available in 42 percent liquid concentrate containing either 2 or 4 pounds of technical grade aldrin per gallon. For a 0.5 percent emulsion, add 1 gallon of the 2-pound concentrate to 47 gallons of water, or 1 gallon of the 4-pound concentrate to 95 gallons of water.

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b. Chlordane - One Percent Emulsion

Chlordane is available as 46-48 or 72-74 percent water emulsion concentrates with either 2 or 4 pounds, respectively, of technical grade toxicant per gallon. The 1 percent emulsion is prepared by adding 48 gallons of water to 1 gallon of the 46 percent concentrate, or 95 gallons of water to 1 gallon of the 72 percent concentrate.

c. Dieldrin - One-half Percent Emulsion

This chemical is available as 18 percent emulsion concentrate, containing 1.5 pounds of technical grade dieldrin per gallon. To prepare a 0.5 percent strength, add 36 gallons of water to each gallon of the 18 percent concentrate.

d. Lindane - Eight-tenths Percent Emulsion

Lindane is the gamma isomer of Benzene Hexachloride. Lindane is available in 20 percent liquid concentrate. To prepare 0.8 percent strength emulsion use one gallon of 20 percent concentrate to 25 gallons of water.

In case the insecticides are not available at the various localities in the concentrations listed above, the following example may prove helpful in computing the correct portions of diluent and insecticides for the usage strength desired:

Divide the percent of concentrate of toxicant by the percent of strength in the solution to obtain the total number of parts in the solution. For example, 30 percent concentrate divided by 6 percent solution equals 5 parts in solution, of which 1 part is concentrate and 4 parts are diluent or 1 gallon of concentrate to 4 gallons of diluent.

Aldrin and chlordane do not follow this rule of thumb formula closely because these technical grade chemicals are rated only by the actual weight of the toxicant ingredient per gallon and not by the volumetric strength percentage. However, if the rule of thumb formula is applied, it results in a more concentrated formula than needed.

7. SOIL TREATMENT

Every case of termite trouble requires individual consideration. The suggestions given relate principally to some of the more simple soil treatments. When properly applied, they should give several years of remedial protection.

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a. Concrete Slab on Ground

The control of infestations occurring beneath concrete floor slabs on the ground is very difficult and sometimes hazardous. This is especially true where radiant heat is concerned, since pipes are buried in the concrete and may be damaged when drilling holes in the floor through which a soil poison is poured, or forced, to treat the ground below.

Where pipes are not present in the slab, one-half or three-quarter inch holes are drilled about one foot apart and six inches from the wall. An alternate method consists of drilling the holes through the foundation wall about five feet apart and introducing the chemical into the ground under pressure just below the slab. When insecticide is applied by pressure, it is recommended that a subslab injector equipped with an expander ring be used (similar to B and G subslab injector). This will fit tightly in the hole to prevent blowback. If there are utility lines coming up through the slab or if there are any cracks in the slab, the surrounding areas would be treated similarly and all cracks pointed up.

In addition, it is recommended that a trench six to eight inches wide be dug about a foot deep along the exterior walls, taking care not to go below the top of the footing. If the footing is more than twelve inches deep, crowbar, pipe, or rod holes about an inch in diameter and a foot apart are made from the bottom of the trench to near the footing. This will help to distribute the chemical evenly along the wall.

At least 2 gallons of the diluted emulsion per each 5 linear feet of wall is applied through holes made in the floor or foundation. Treatment around the entire slab and around other openings left for plumbing, etc., is necessary. The emulsion is applied at the same rate in the trench made along the exterior foundation walls, if the footing is not more than 15 inches deep. If deeper in some places, apply as directed below for crawl-space houses.

b. Crawl Spaces

Infestations occurring along walls or around supporting piers of basementless houses are treated by digging trenches along both sides of the walls and around all sides of piers using the dimensions and techniques suggested in paragraph 7a above for trenching along exterior walls of concrete slab-on-ground houses.

Two gallons of the diluted emulsion are applied per each 5 linear feet of trench along the interior of the foundation walls, or around piers or other materials

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connecting the ground with wood above. Along the exterior foundation walls, including the part adjacent to entrance platforms, porches, sunparlors, etc., the chemical is applied at the rate of 2 gallons per 5 linear feet for each foot of depth from the surface to the footing. Thus, if the footing is 2 feet deep in some places, increase the dosage to 4 gallons of the chemical per each 5 linear feet of trench, or if it is 5 feet deep, use 10 gallons of the chemical per linear unit. The enclosed areas adjacent to the foundation wall, such as entrance platforms, should be either trenched along the foundation and treated, or have holes bored through the slabs and the chemical applied through them.

c. Basement Houses

Where the termites are coming from beneath the concrete floor in the basement, any wood that may extend into the ground is removed, the soil is poisoned as recommended for slabs on ground, and cracks or holes through which termites may enter are sealed. Large cracks or holes would be filled with dense cement mortar and small ones with a roofing-grade coal tar pitch. Where the infestation is located between the floor and wall (expansion joint) or around a furnace, a series of one-inch holes are made, spaced about one foot apart, through which a chemical can be poured. Holes along a wall should be made about six to eight inches from it, so as to clear the footing and reach the soil beneath. Exterior foundation walls in houses having full basements are treated to a greater depth than for the other types of houses. The trench is prepared in the same way, but the pipe or rod holes should extend a total of about thirty inches below ground level to aid proper distribution of the chemical to all parts of the wall. This is especially important in masonry foundations where numerous mortar joints are present below grade--some of which may be susceptible to termite penetration.

Where it is necessary to treat the basement floor, the chemical would be applied in the same manner and at the same rate as recommended for treating the slab-on-ground house. When treating along the exterior of the foundation wall, the rate mentioned for the crawl-space house is used.

d. Voids in Unit Masonry Foundations

Where termites have infested the voids in the walls or piers, holes are made in the mortar joints in the lower part of the wall or pier near the floor, and the chemical is applied at the rate of 1 gallon per 5 linear feet along the wall or around the pier.

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8. BACK FILLING TRENCHES

Some of the chemical should be poured or sprinkled at the bottom of the trench which would then be covered with a layer of soil about 6 inches thick. More of the chemical would be poured or sprinkled on top of this layer, mixed thoroughly with the soil, and tamped. This process would then be repeated until the trench is filled. Chemicals should not be applied to water-soaked or frozen soils, because the chemicals will not be well distributed and the desired control may not be obtained.

9. CAUTION

The chemicals herein mentioned are poisonous to man and other warm-blooded animals and must be handled with care. Do not permit them to come in contact with the skin. Wear rubberized gloves for protection. Where the poison is being applied with pressure through holes in the walls and piers, use cellulose acetate face guard so that the chemical cannot splash back into the face. If contact with the soil poison occurs, wash the skin immediately with warm soapy water. When the chemical is being applied in an enclosed or unventilated area, a free circulation of air should be available, or provided by some means of mechanical ventilation, and face masks supplied for the operators. Never apply these chemicals in places where they might be leached from the soil and enter wells that supply drinking water. Keep children and pets away from the areas where these poisons are being prepared and used.

10. TREATMENT OF TERMITE SHIELDS

The only effective mastic coating recommended to date as being 100% successful in resisting penetration by subterranean termites is old-style roofing pitch having a coal tar base. The use of this coating applied generously at the vulnerable overlap joints of the sheet copper or galvanized termite shields, installed between the foundation wall and the sill, will make the shields much more effective. The PHA recommends that the overlap joint be not less than 4 inches. Thus, the termites will have to build their tubes around the shield where they will be exposed to detection and can be destroyed and the ground area treated with chemicals.

11. PREVENTATIVE MEASURES

The best time to provide for prevention and protection against subterranean termites is during the planning and construction of the building. This recommendation is the result of years of research on the habits and behavior of

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termites and through experience in their control. Improper design and construction of buildings without consideration of the termite problem will often result in infestation. Recommendations on design, construction, and the use of wood preservatives should be followed without deviation. Common errors include burial of stumps, logs, boards, stakes, and wood scraps beneath buildings; improper grading and drainage; insufficient air circulation and cross ventilation; failure to use wood treated with preservatives; failure to install properly formed and correctly constructed shields; and failure to provide chemical treatment of the soil under a concrete slab on ground before pouring the concrete.

CHAPTER 2 - NONSUBTERRANEAN TERMITES

1. INTRODUCTION

There are several types of nonsubterranean termites, the most common and destructive being of the genus Kalotermes, or dry-wood termite. Another is of the genus Zootermopsis, the damp or rotten-wood termite. They are somewhat larger than the subterranean termites which are approximately 1/8 inch long whereas the Kalotermes nymph and the Zootermopsis nymph are 1/4 and 3/8 inch long, respectively. Other different nonsubterranean kinds, such as the powder-post, vary from 1/3 to 1 inch in length.

2. CHARACTERISTICS AND RECOGNITION

Nonsubterranean termites have been found in temperate, subtropical, and tropical regions of both hemispheres. However, they are common in only a few localities throughout the world. In North America they are restricted chiefly to warm coastal areas.

Dry-wood termites are found in a narrow strip along the Atlantic coast from Cape Henry, Virginia, to the Florida Keys; westward along the coast of the Gulf of Mexico to the Pacific coast as far as northern California; with a local infestation at Tacoma, Washington. On this continent powder-post termites are restricted to Florida and Louisiana. The rotten-wood termites range from British Columbia and Vancouver Island southward along the Pacific coast to Baja, California. They have also been found in Idaho, Montana, Nevada, Arizona, and New Mexico. The damp-wood termites occur in southern Florida, in the Southwestern States, and along the Pacific coast.

Nonsubterranean termites, like their subterranean relatives, live in colonies. Whereas subterranean termites live in the ground, these termites live in the wood throughout their lives. There are only two castes of adults--the reproductives and the sterile soldiers. There is no worker caste, as in subterranean termite colonies. The work is done by the young nymphs before they become mature adults.

The reproductive adults may be light yellow to dark brown or blackish. They can be distinguished from subterranean termites by the presence of branches between the upper rim of the wing and the first long vein below.

The soldiers are comparatively large, wingless forms. They are the protectors of the colony and have powerful jaws for fighting purposes, with teeth along the inner edge. Subterranean termite soldiers do not have these teeth.

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When the reproductives first become adults, they have wings and can fly. Those that fly at night are attracted by lights. If the lights shine through closed windows, the termites may congregate on the sills. If they emerge inside a building, they cluster against the glass, trying to escape, most of them dying in the attempt.

Unless carried by the wind, nonsubterranean termites fly only short distances in search of a place to start a new colony. As soon as they find suitable quarters, they rid themselves of their wings, and the males and females pair off and bore holes into the wood, for, unlike subterranean termites, they do not enter the wood by building tunnels up from the ground.

When a male and female are established in the wood, they plug the openings with small particles of excrement held together with a dark cementlike substance which they secrete from their mouths. The female, or queen, soon begins to lay eggs, usually one at a time, which hatch into tiny white nymphs.

The male continues to live with and fertilize the female. As the colony grows the tunnels are enlarged laterally. Colonies grow very slowly, and even old colonies contain only a few thousand individuals. They are much smaller than colonies of subterranean termites.

The entire colony is not confined to a single chamber, but is distributed throughout galleries in the wood. The nymphs keep the galleries clean, and permit no pellets of excreta or other dirt to remain where they are feeding. They either place these pellets in unused chambers or cast them outside through small openings in the wood. In this habit they differ from subterranean termites.

The dry-wood and powder-post termites attack dry sound wood, in which their colonies live without contact with the ground. These are the species that damage furniture and other woodwork within buildings. The damp-wood and rotten-wood termites, however, require moisture. They may be found in the sapwood and heartwood of living trees, as well as in timber. Damp-wood termites may leave the wood to burrow into the earth; they have been known to attack fruit trees by burrowing from root to root.

3. HAZARDS OF INFESTATION

Nonsubterranean termites cut across the grain of the wood and excavate broad pockets or chambers connected by tunnels about the diameter of the termite's body. They destroy both the soft spring wood and the harder summer growth, whereas subterranean termites attack only the spring wood. Cross sections

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through timbers infested with nonsubterranean termites do not show the definite pattern of destruction that is characteristic of damage by subterranean termites. The structural weakening is less serious, and they work more slowly.

In certain localities, however, especially at Key West, Miami, and Tampa in Florida, and Los Angeles, San Diego, and other cities in southern California, nonsubterranean termites damage buildings and furniture. Sometimes they riddle telephone and power poles to such extent that it is dangerous for linemen to climb them.

In the San Francisco Bay section rotten-wood termites infest more buildings than do subterranean termites. At Key West the rough-headed powder-post termite is responsible for practically all the damage caused by termites.

It is in the tropical regions outside the United States that damage by nonsubterranean termites is most severe; and, in some places, building codes prohibit the construction of wooden floors.

Nonsubterranean termites are easily spread because they can live in wooden objects that are frequently moved. They have been found infesting furniture in many localities outside their normal range. However, these termites have not become established in any northern localities.

4. INSPECTION

Nonsubterranean termites are seldom seen. They remain hidden within the wood, except when they make dispersal flights. Piles of shed wings are evidence of such flights. These termites never crawl freely over exposed surfaces, as ants do. However, there are several other external indications of infestations.

a. Termite Plugs

Nonsubterranean termites seal all openings in the wood with a brownish or blackish substance which they secrete. This secretion soon hardens into cementlike plugs, usually paper thin. These plugs may contain pellets of excreta. The openings may have been made by boring beetles; or they may be the entrance holes of the original pair of adult termites, exit holes made for a colonizing flight, or holes cut to change the temperature and humidity in the galleries.

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b. Pellets of Excreta

Nonsubterranean termites excrete pellets of partly digested wood; subterranean termites do not. These pellets, which vary in size, may be found in the tunnels and in piles on the floor where they have been ejected from infested wood. The color is usually that of the wood fed on by the termites. There is one powder-post beetle, an anobiid, that also ejects pellets from the wood, but termite pellets can be distinguished by their concave survaces. These pellets are often the first warning that nonsubterranean termites are at work.

c. Shelter Tubes and Partitions

The termites may also construct thick, narrow shelter tubes of secreted substances and excretal pellets to serve as passageways from one piece of wood to another. If the pieces of wood are no more than half an inch apart, the termites may wall in the space between them. Using the cementlike substance for walls, they may also partition off large chambers into several smaller ones.

d. Surface Blisters

The termites may form chambers close to the surface of the wood. They eat the wood away, leaving only the merest film or blister, if the wood is unpainted, or only a flimsy coating of paint on painted surfaces.

e. Hollow Sound on Tapping

Infested wood may also be detected by tapping on the wood with the finger or a piece of metal. A hollow sound or papery rustle may indicate the presence of termite tunnels just beneath the surface.

5. PRINCIPLES OF CONTROL

In regions where nonsubterranean termites occur, certain measures can be taken to prevent damage.

a. Inspection of Lumber Before Use

All lumber, especially secondhand lumber, used for construction purposes should be inspected carefully for evidences of infestation, such as plugs and pellets of excreted wood. Infested lumber should never be used. Lumber discarded from infested houses that are being remodeled is a source of danger and should be burned.

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The transportation and reuse of lumber infested with nonsubterranean termites is prohibited by law in the Canal Zone, in Panama, and in Pasadena, California. At Honolulu, Hawaii, it is prevented by police regulation.

b. Screening

All doors, windows, especially attic windows, and other ventilation openings should be screened with noncorrodible-metal wire cloth, preferably having 20 meshes to the inch. Such screens will prevent the entrance of winged termites from the outside.

c. Treatment of Wood

Construction timbers can be pretreated or impregnated with a chemical wood preservative to prevent termite attack. Such treatment is costly, however, and is practicable only for use in large buildings or for public service poles and similar equipment.

If impregnated timber is not available, considerable protection can be obtained by dipping timbers for 3 minutes in a 5-percent solution of pentachlorophenol as a diluent (diluting agent) mixed with an appropriate quantity of toxicant, or brushing with this solution. (See formulae under Chemicals and Their Preparation in paragraph 6 below.) If applied by brushing, three coats are required. Care should be taken that all surfaces, including the ends and mortises or other cuts, are thoroughly treated.

Fiber or wood-pulp products may be treated with white arsenic or pentachlorophenol to protect them from damage, but the treatment is usually made in the process of manufacture.

Several coats of heavy paint will give the exterior woodwork of buildings considerable protection against termite entry. All cracks, crevices, and joints between timbers should first be filled with putty or plastic wood.

d. Use of Termite-Resistant Woods

Many kinds of termite-resistant woods have been found throughout the world. Such woods should be used, if possible, where there is danger of infestation. Of construction timbers, the close-grained heartwood of foundation-grade redwood, tidewater-red baldcypress, or very pitchy (lightwood) longleaf pine--especially if painted--give greatest protection against nonsubterranean termites.

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e. Use of Steel or Concrete Construction

The use of steel, concrete, stone, or brick, instead of timber, in building construction offers the best protection against nonsubterranean termites. However, it will not prevent infestations of wooden materials inside unless the building is thoroughly screened.

6. CHEMICALS AND THEIR PREPARATION

Where wood has been extensively damaged but not structurally weakened by these termites, an insecticide, either a liquid or a dust, may be injected into their galleries. To reach the galleries, auger holes should be bored into the wood about 18 inches apart. After treatment, the holes should be sealed with putty or similar material.

Five percent pentachlorophenol in the past has been employed as an insecticide; however, it gives a much better performance as a wood preservative. It also makes an excellent diluent for use with an insecticide and so serves in a dual capacity when applied to wood. It may also be purchased in a 20 percent strength concentrated form. Other recommended diluting agents are a deodorized Kerosene, such as Deobase or Ultrasene.

a. Liquids

The following five insecticides are effective when dissolved in any of the above diluents at the strength indicated below, which is sufficient to leave a toxic residue in the galleries. These mixtures may be applied with a knapsack type sprayer by inserting the spray rod, without nozzle attached, into the holes.

The above diluents may remove the paint or varnish finish from the wood, but it can be readily restored.

(1) Aldrin - One-half Percent Solution

The concentrate contains either 2 or 4 pounds of technical grade liquid concentrate aldrin per gallon. For a 0.5 percent solution, use 1 gallon of the 2-pound concentrate to 47 gallons of diluent, or use 1 gallon of the 4-pound concentrate to 95 gallons of diluting agent.

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(2) Chlordane - Two Percent Solution

Chlordane is available in 46-48 or 72-74 percent liquid concentrate. The 2 percent solution is prepared by adding 24 gallons of diluent to 1 gallon of the 46 percent concentrate, or 48 gallons of diluent to 1 gallon of the 72 percent concentrate.

(3) Dieldrin - One-half Percent Solution

This is available in 18 percent liquid concentrate, containing 1.5 pounds of technical grade dieldrin per gallon. To prepare 0.5 percent strength use 1 gallon of the 18 percent concentrate to every 36 gallons of diluting agent.

(4) Lindane - Eight-tenths Percent Solution

Lindane is the gamma isomer of Benzene Hexachloride. Lindane is available in 20 percent liquid concentrate. To prepare a 0.8 percent strength solution, use 1 gallon of 20 percent concentrate to 25 gallons of diluent.

(5) DDT - Six Percent Solution

This chemical is available in 25 to 35 percent liquid concentrate. To prepare a 6 percent strength solution use 1 gallon of 25 percent concentrate to 3 gallons of diluent, or 1 gallon of 35 percent concentrate to 5 gallons of diluent.

The rule of thumb formula for subterranean termites discussed in Chapter 1, paragraph 6, for concentrations other than those set forth above, may be applied for the chemicals enumerated above.

b. Dusts

When it is not practicable to use a liquid poison, a dust may be blown into the galleries with bellows, and any holes sealed. The dust adheres to the bodies of the termites, and thus the poison is spread from gallery to gallery until the entire colony is destroyed.

Several arsenical dusts, such as smelter dust, white arsenic, and Paris green, as well as DDT (50 percent) are suitable. Sodium fluosilicate is not quite as effective, but is less poisonous to man and animals.

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Care should be taken not to blow in too much dust, since this might cause the termites to wall off their galleries. In local infestations one-half teaspoonful in each hole is sufficient.

In large-scale operations the use of commercial dust guns which maintain pressures of 70 to 75 pounds per square inch will give better distribution of the dust. An ounce of dust for every 15 to 30 holes should be enough.

Sometimes dust blown into termite galleries becomes caked from moisture. If inspection shows that this has happened, the treatment should be repeated.

c. Fumigation

Detached houses heavily infested with nonsubterranean termites have been fumigated with success. It is particularly desirable where there are several heavily infested detached buildings with inaccessible infested timbers.

This method is quicker and often cheaper than the use of poison liquids and dusts, but it does not prevent the termites from returning, since no poisonous residue is left in the galleries. Moreover, fumigation is very dangerous and should be conducted only by licensed fumigators.

Occupants should not reenter a fumigated building until it has been thoroughly aired--48 hours after fumigation with hydrogen cyanide and 24 hours after fumigation with methyl bromide. Altogether it requires 4 days to treat and aerate a house with the cyanide and 2 days with the bromide.

7. REMEDIAL MEASURES

When wood has been found infested with nonsubterranean termites, certain remedial measures may be taken to keep them from doing further damage.

a. Replacement of Infested Wood

Infested lumber, woodwork, or furniture should not be transported or sold for reuse elsewhere. It should be removed, destroyed, and replaced with chemically treated wood.

b. Use of Heat or Cold

Termites in infested furniture will be killed if the furniture is kept for 1 1/2 hours in a chamber heated to 150° F. or for 4 hours in a chamber heated to 140° F. Kilns or special vaults equipped with heating units using steam or

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electricity may be used for the purpose. This treatment is also likely to kill most other insects, such as bedbugs, carpet beetles, and clothes moths, that might be present in the furniture.

Cold has also been used to kill these termites. In northern climates infested furniture and crates may be moved outdoors in winter; in the Tropics they may be placed in refrigerating vaults. Exposure at a temperature of 15° F. for 4 days will kill the termites within the wood.

c. How To Restore Damaged Surfaces

When infested wood has lost its firmness or is unsightly but still strong enough for its intended use, wiping it with melted paraffin will restore its body. The excess paraffin should be removed with a rag, and the wood refinished. If the damage is more severe, it may be necessary to cut away the injured wood with a chisel and fill the cavity with putty or plastic wood. The entire article should then be refinished.

8. CAUTION

All the insecticides discussed above are poisonous to man and animals. They should be handled with care and in accordance with instructions on the labels of the containers. They should not be applied where they might contaminate food or drinking water, and they should be stored out of reach of children and pets.

Pentachlorophenol and kerosene, the recommended diluents, are particularly irritating to the skin and eyes. When these materials are applied, the hands should be protected, and care should be taken to keep the material away from the eyes.

Since mixtures containing kerosene or pentachlorophenol are inflammable, they should be kept away from high temperature areas and open flames.

When handling insecticides in dust form, it is desirable that the operator be equipped with a face mask.

HHFA-PHA, Wash., D. C.

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