



Subterranean Termites

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Subterranean termites are the most destructive insect pests of wood in the United States. They cause billions of dollars in damage each year and have a negative impact on a family's most valuable possession—the home.

In nature, subterranean termites are beneficial because they break down cellulose into usable nutrients. The biomass resulting from this process is recycled to the soil as humus. Subterranean termites are, therefore, considered important in our ecosystem.

Problems occur when termites attack the wooden elements of homes, businesses and warehouses built by humans. The presence of termites is often not readily noticed because their activity is hidden behind wallboards, siding or wood trim. Homeowners in all areas of Texas should watch for subterranean termites and take precautions against infestations. To minimize damage from termites, it is helpful to know the description, life cycle and signs of infestation of termites as well as preventive and control measures.

Distribution

Several species of subterranean termites are found in the United States; they live in every state except Alaska. Two major types of subterranean termites are commonly found in Texas. They are the native subterranean termite and Formosan subterranean termite, and both are serious threats to wooden structures.

Native subterranean termite species in the Genus *Reticulitermes* are found throughout the

state. Overall, *Reticulitermes* termites are considered the most economically important because they are so broadly distributed.

The second and increasingly important termite is the introduced Formosan subterranean termite, *Coptotermes formosanus*. The Formosan termite is easily transported from one infested area to another in landscape timbers, railroad cross-timbers, mulch and wooden pallets. Isolated infestations of Formosan termites have been reported in many areas of the state (See E-367, "Formosan Subterranean Termites").

Identification

Subterranean termites are social insects that live in colonies within the soil, hence their name "subterranean." These colonies contain three forms or castes: reproductives, workers (pseudergates) and soldiers. Subterranean termites have several stages: the egg, larva, apterous workers (wingless), a brachypterous nymph (with wing pads), soldiers and adult swarmers. There are three forms of adult reproductive termites including primary, secondary and tertiary (Fig. 1a).

Reproductive males and females can be winged (primary) or wingless (secondary or tertiary). Females of each can lay eggs and produce new offspring. The bodies of winged primary reproductives, also called swarmers or alates, vary by species from coal black to pale yellow-brown. Wings may be pale or smoky gray to brown and have distinct vein patterns used in identification. *Reticulitermes* swarmer termites are about $\frac{1}{4}$ to $\frac{3}{8}$ inch long.

Secondary and tertiary reproductives live within the colony and are white to cream-colored. These termites form a backup for the primary queen and may replace her if she is

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injured or dies. These termites mate within the colony and lay viable eggs. If supplementary reproductives and worker termites become isolated from the main colony, they can establish a new sub-colony.

Termite workers make up the largest number of individuals within a colony and do all the work. They are wingless, white to creamy white and 1/4 to 3/8 inch long (Fig. 1b). They forage for food, feed the other castes, groom the queen and maintain and build tunnels and shelter tubes. Their mouthparts are very hard and adapted for chewing through wood or other cellulose materials. The worker caste is responsible for the damage that makes termites an economically important problem.

Soldiers resemble workers in color and general appearance, except they have well-developed brownish heads with strong mandibles or jaws (Fig. 1c). Soldiers defend the colony against invaders, primarily ants and other termites. They cannot forage for food or feed themselves, and they depend on the workers to care for them.

Ants and termites often swarm at about the same time of year but control measures for each differ greatly. It is therefore, important to be able to distinguish between swarming termites and ants. (Fig. 2).

Biology and habits

After 2 to 4 years a subterranean termite colony is mature and produces "swarmers" (winged primary reproductives). Termite swarmers leave the colony in large numbers during the spring and early summer. Swarming begins in South Texas in January and February; in the



Figure 1. Subterranean Termites.

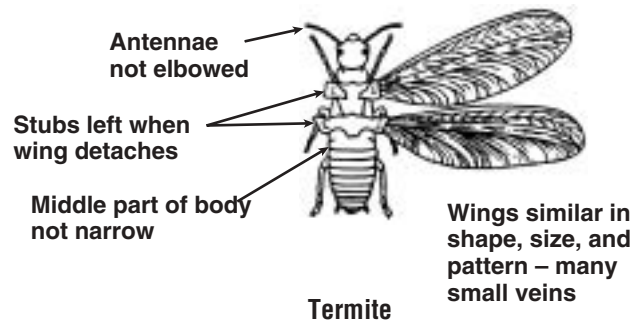
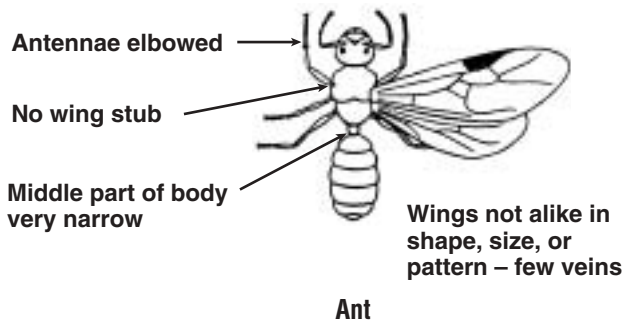


Figure 2. Differences between ants and termites.

Panhandle region of Texas, swarms do not occur until April and May. Environmental factors such as heat, light and moisture trigger the emergence of swarmers, with each species having its own set of requirements. The number of swarmers produced is proportional to the age and size of the colony. A summary of termite biology is shown in Figure 3.

Both male and female swarmers fly from the colony and travel short distances. Termites are weak fliers and must rely on wind currents to carry them to new habitats. Only a small percentage of swarmers survive to develop colonies; most fall prey to birds, toads, insects and other predators, and many die from dehydration or injury.

During the swarming process, males (kings) and females (queens) pair off using pheromones. Successful reproductive pairs land, lose their wings and seek cover under rocks or other moist materials. A pair will make a very small nest before mating. Initially, the new queen termite lays only a few eggs. The male

remains with the female and helps care for developing eggs and the larva that hatch.

Eggs are not deposited continuously. In fact, only a few hundred are deposited during the first year. As the young queen grows larger, she lays more eggs. The king and queen care for the young larvae that hatch from the eggs because they cannot care for themselves. The larvae then molt into pseudergate workers, which, in turn, can molt into presoldiers or brachypterous nymphs (with wing pads). These nymphs will eventually molt to become primary reproductives. The colony stabilizes when the queen reaches her maximum egg production. If the queen dies, supplemental reproductives take over the queen's duties.

The maximum size of a termite colony depends on location, food availability and environmental conditions, especially temperature and moisture. Some colonies remain small; others contain up to several thousand individuals. New colonies form when the old colony produces swarmers or when groups of

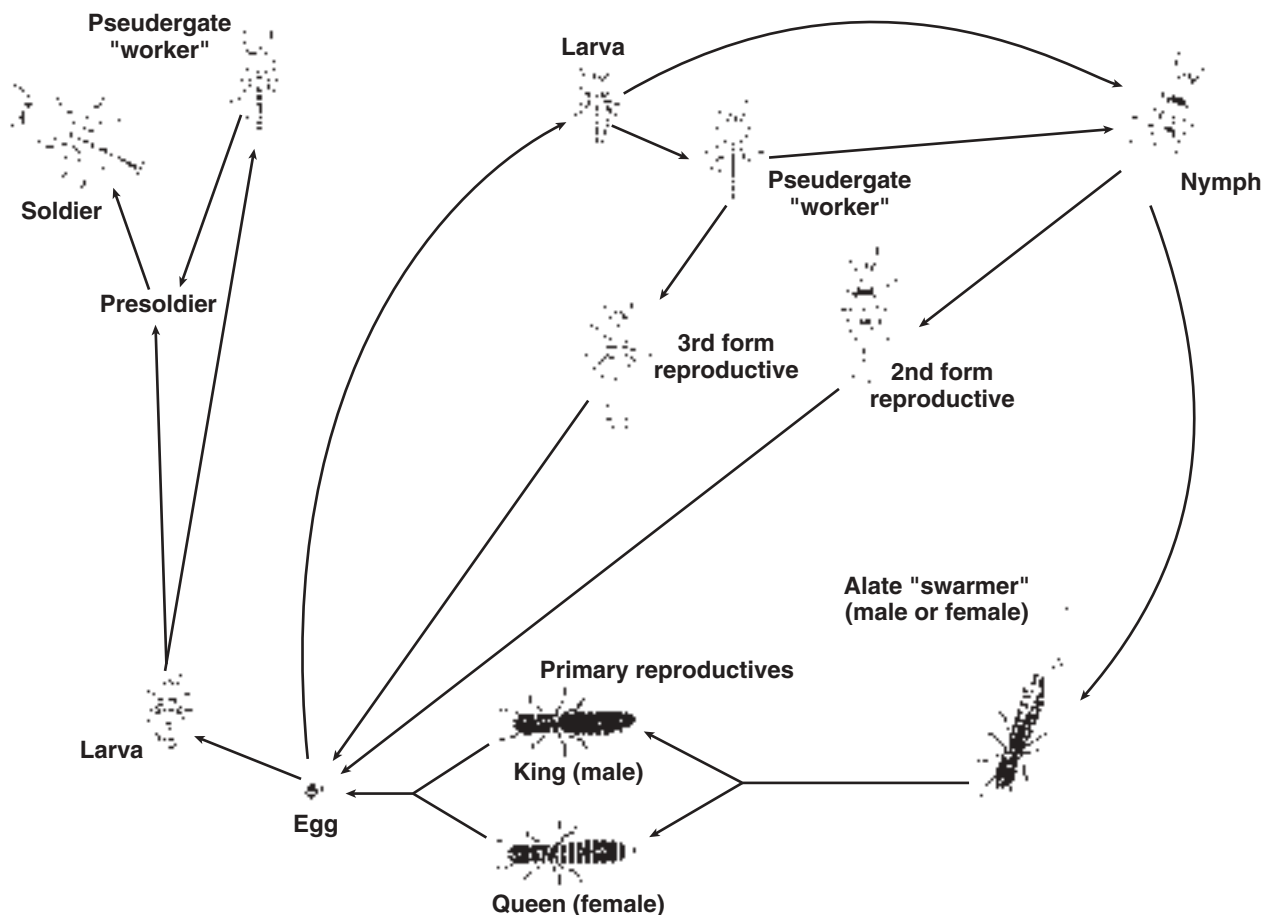


Figure 3. Native subterranean termite life cycle.

termites become isolated from the main colony and establish sub-colonies. This is called "colony splitting" or "budding." These sub-colonies may exist independently or reunite with the main colony.

Subterranean termites get their nutrition from wood and other material containing cellulose. Paper, cotton, burlap or other plant products often are actively consumed by termites. Sometimes termites will even tunnel into the dead heartwood or pith of living plants. Most species of subterranean termites cannot digest cellulose directly and depend on single-celled protozoans and bacteria living in their hindguts to help digest the cellulose. Digested cellulose is then shared with the developing larvae, other workers, soldiers and reproductives.

Termites are attracted to certain odors of wood-decaying fungi that make the wood more palatable and easier to penetrate. In some instances, the fungi provide a source of nitrogen in the termite diet.

Moisture is important to subterranean termites as they have very little resistance to dehydration. To survive, termites must maintain contact with the soil (their primary moisture source) or other above-ground moisture sources, such as defective plumbing, leaky roofs, leaks from air conditioning condensers or poorly maintained gutters.

Subterranean termites also must protect themselves from temperature extremes and attack by ants and other insects. Termites that forage for food above ground protect themselves with shelter tubes or "mud tubes" (Figs. 4a and b). Worker termites build shelter tubes from particles of soil or wood and bits of debris held together by salivary and fecal secretions. Mud tubes may be thinly construct-



Figure 4a. Termite shelter tubes on foundation wall.

ed or can be large with thick walls to accommodate many termites moving vertically between the soil and their food source.

Subterranean termites also transport moist soil into the structures they infest. The presence of shelter tubes and mud within galleries is used to identify termite-damaged wood (Fig. 5). Shelter tubes are often used to bridge across masonry or other objects, allowing termites access to a food source (wood) above ground. Inspecting of structures for termite damage may identify these tubes which indicate an ongoing infestation.

Damage

Dead trees and brush provide a natural food source for foraging subterranean termites. When natural vegetation is cleared and houses are built, termites often switch to feeding on wooden structures. Termites enter buildings through wood that is in direct contact with the soil and by building shelter tubes over or through cracks in foundations. Any cellulose material in direct contact with the soil, such as trees, vines or plumbing fixtures, can serve as an avenue of infestation.

Signs of infestation

Active termite infestations can be difficult to detect. To find out if a home is infested, the structure should be checked for evidence of swarmers (including wings or dead termites in windows), mud tubes or damaged wood inside or around a structure.

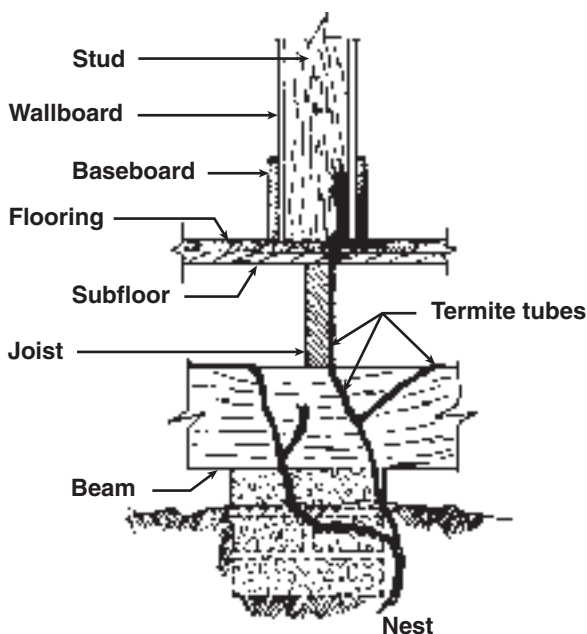


Figure 4b. Typical termite shelter tubes.



Figure 5. Typical wood damage by subterranean termites.

Swarmers: Generally, the first sign of infestation homeowners notice is swarming reproductives on windowsills or near indoor lights (Fig. 1a). Swarming termites inside the house usually indicate an active infestation in the structure. Termite wings may be found on windowsills or stuck to cobwebs indoors. Though swarmers outdoors are a natural phenomenon, they indicate that termites are present and may be attacking nearby structures.

Mud tubes: Mud shelter tubes on crawl space piers, utility penetrations or on foundation walls and slabs are a sign of termite infestation. Termite shelter tubes can blend in well with the soil or concrete, making them difficult to see. To make inspecting the home for termites easier, prune vegetation away from house walls. The soil line should be several inches below the top of slabs or foundation walls. An inspector should look for mud tubes carefully along foundation walls and slabs, especially along cracks, in corners or where the top of the foundation is close to the ground. A screwdriver is useful to break open suspected termite tubes and detect live termites.

Damaged wood: Wood damage often is not found initially, but is positive indication of a current or past termite infestation. Wherever wood comes in contact with the soil there is a high risk for termite entry. Carefully examine any wood that thuds or sounds dull when struck by a screwdriver or hammer. Probing suspected areas with a sharp instrument such as a screwdriver or an ice pick will often disclose termite galleries or damage.

Characteristics of damaged wood

Subterranean termite damage is usually confined to the soft, spring-growth of wood (Fig. 5). Termite tunnels and galleries tend to follow the wood grain and are lined with mud or may have a pale, spotted appearance resulting from

soft fecal material plastered on tunnel surfaces. Moisture sources may cause wood decay and can encourage subterranean termite infestation. Deterioration caused by wood-destroying fungi can be confused with termite damage.

Other insects attack wood, and their appearance or the nature of their damage varies widely. For more information, refer to E-366, "Drywood Termites"; E-367, "Formosan Subterranean Termites"; L-1783, "Carpenter Ants"; L-1826, "Carpenter Bees"; and L-1784, "Wood Destroying Beetles."

Management

Control measures include reducing the potential for subterranean termite infestation, preventing entry, using termite bait and applying residual chemicals for preventive or remedial treatment.

Inspection

Although it is possible for a homeowner or property manager to perform an inspection, it is recommended that licensed professional inspectors do this work. They should be familiar with termite biology and habits as well as construction methods and conditions that are conducive to termite attack and infestation. Pest control professionals can determine the presence of infestations and damage, the need for remedial control measures and the measures to use to eliminate the conditions that encourage termite attacks.

Tools and equipment needed for an inspection include a flashlight, ice pick or sharp-pointed screwdriver, ladder and protective clothing (bump cap, coveralls, rubber knee pads). A clipboard, graph paper and floor plan or sketch help in recording inspection findings accurately and ensuring that the entire structure has been examined. A moisture meter can often detect moisture levels in walls that encourage subterranean termite infestations. Motion detectors, x-ray technology, acoustical detectors, infra-red cameras and fiber optic boroscopes are also available for termite inspections.

Where to check outside.

It is recommended that professional inspectors do the following when looking for termite infestations:

- Examine the foundation of the house, garage and other structures for shelter tubes coming from the soil (Fig. 4a and b). Make note of any cracks or foundation damage through which termites might enter.

- Report any places around the foundation where soil extends above the top of the foundation, including built-in planter boxes with soil grades above the brick or stucco line. Pay special attention to attached porches, connecting patios, side-walks, areas near kitchens or bathrooms and narrowly confined or hard-to-see places. Note any area where inspections cannot be made.
- Check the soil around or under the foundation to determine if faulty grade construction creates moist areas next to the structure. Irrigating the soil around the foundation may help prevent the slab from cracking, but it can also attract foraging termites. Check windows and door-frames and where utilities (air conditioning pipes, gas and electric services) enter the structure for termites or wood decay.
- Check roof eaves and gutters for defects that might cause leakage and eventual wood rot. Inspect behind closely planted, dense shrubbery or foliage.
- Note any earth-to-wood contact such as fences, stair carriages or trellises.
- Open and examine any exterior electrical meter or fuse box set into the walls, a common point for infestation.
- Carefully inspect wood materials next to swimming pools that may be splashed frequently by water.

On the inside, the inspector should:

- Probe or carefully sound exterior porches, doors and window facings, baseboards, and hardwood flooring. Be careful not to deface finished wood when probing.
- Check for unusual moisture levels and signs of infestation around earth-filled porches or other termite-prone features. Check ceilings for water damage (conductive conditions).
- Examine all cracks or expansion joints in the foundation and any unusual blistering in paint or wallboard surfaces. Discoloration or staining on walls or ceilings may indicate water leaks that can decay wood and aid termite infestations. Inspect where plumbing or utility pipes enter the foundation or flooring.
- Check floor coverings for raised or split areas.
- Carefully examine the plumbing, particu-

larly in bathrooms on slab construction. **If no access to the bath trap area exists, install a removable plumbing hatch and periodically check the trap for termite shelter tubes.**

- Examine the attic for shelter tubes, water leakage, wood rot or damaged wood.
- If the house is of pier and beam construction, inspect the area between the floor and the soil (crawl space) (Fig. 6). Examine the inside of the beams, chimney bases, hearths or piers for shelter tubes. The crawl space should have a minimum 18-inch clearance between floor joists and the soil, and at least 12 inches between floor beams and the soil.
- Look under and around earth-filled porches, patios, planters and bathrooms for water leakage and termite damage. If water stands underneath the house, take action to control this moisture.
- Look carefully at the top of the foundation wall where the floor and the wall intersect.
- Closely examine plumbing and utility lines passing through the floor of foundation walls.

Prevention

Many termite problems can be prevented through sound initial designs, mechanical alterations and good construction sanitation. The basic premise behind prevention is to deny termites access to food (wood), moisture and shelter.

Planning before construction is vital. Position or modify the building site so that the soil grade slopes away from the structure in all directions. Existing homes may need remedial grading or

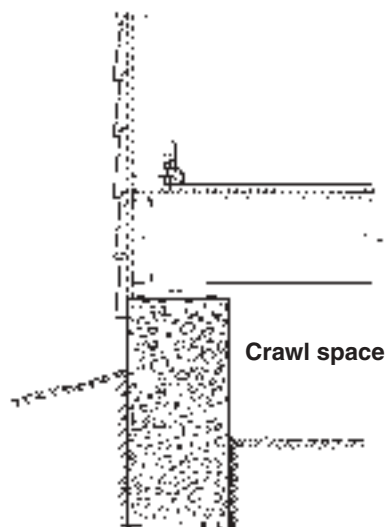


Figure 6. Construction showing crawl space.

installation of positive drain lines. Soil-filled porches, patios, sidewalks or breezeways should slope away from the house.

Soil-filled porches and planter boxes should be removed from the house. Planter boxes should be built so that termites cannot enter from the soil beneath. The soil in the planter boxes should be at least 6 to 8 inches below any wooden structure such as sill plates, window frames or siding.

Eliminate all wood-to-soil contacts, including attached fence posts, stair casings, trellises and door facings. Remove these structures from the soil and set them on masonry blocks or replace them with pressure-treated wood. The soil level should be at least 6 to 8 inches below the top of the foundation or wall covering. This clearance does not prevent construction of shelter tubes over the foundation, but it does allow for visual inspection. Avoid planting shrubbery and dense foliage close to the house, as this increases humidity and hinders inspection of the foundation line.

At least 70 percent of the crawl space soil under pier and beam structures should be covered with 6 mil polyethylene water barrier. This helps prevent moisture build-up in the sub-flooring. Place exterior foundation wall vents opposite each other and close enough to the corners of the foundation to provide cross flow ventilation and eliminate dead air spaces. The number and size of vent openings should provide 1 square foot of ventilation for each 150 square feet of crawl space area.

Wood exposed to rain should be pressure-treated with preservatives. Pressure-treated wood should be used for sill plates and for any

wood that will be in contact with the soil. Rest wood porches, steps and stair carriages on solid concrete bases to separate them from the soil by at least 6 inches. Seal and caulk all foundation openings, such as for plumbing penetrations and service utilities. Remove extraneous cellulose material, such as form stakes, wood scraps or stumps, from underneath and around foundations during and after construction.

Stainless steel mesh or plastic sheeting impregnated with a termiticide is available for long-term termite proofing of new homes. These are normally installed on top of the soil and around plumbing penetrations before the slab is poured to prevent subterranean termites passing through cracks or around pipes to gain access to wood in the structure. To be fully effective, these products should be installed under the whole foundation and not just around plumbing penetrations.

Chemical management

Subterranean termites usually attack structures from the ground up; therefore, termiticides applied to the soil can deter attacks for several years. For complete protection, there must be a **complete** chemical or physical barrier between the structure and the soil. In existing homes, this barrier must be placed wherever there is a point of possible termite entry.

Preconstruction treatments: Treating the soil under a structure with chemicals before construction (pretreatment) can effectively protect it for several years. These chemicals can be applied accurately during early phases of construction and eliminate the need for drilling injection holes in the slab at a later date. Insist that the contractor or architect specify that a preconstruction application of termiticide be applied to the soil before the slab is poured. This is the one time in the life of a structure when the soil beneath the slab can be protected against termites.

Treating only the plumbing penetrations is incomplete. A complete pre-treatment must include all of the soil under the slab as well as trenching and treating the outside perimeter after the final soil grade is established. Though termite baits have been approved in Texas for use in lieu of a pretreatment, this approach to structural protection from termites is not recommended.

Post-construction treatments: For treating existing homes, termiticides should be applied to the soil inside and outside foundation walls, around piers or other supports and around utility entrances (Figs. 6-10). In instances such as

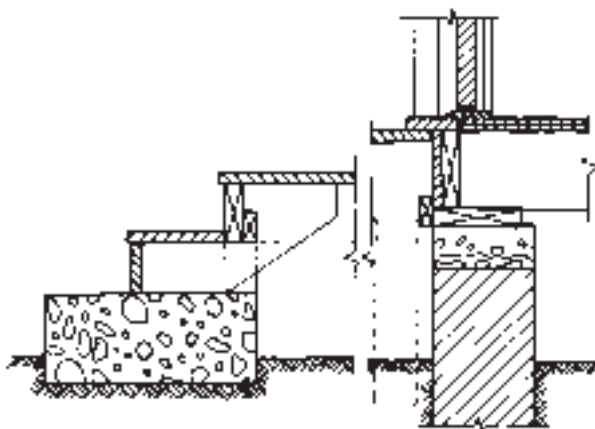


Figure 7. Removing wood-to-soil contact to prevent termite entry.

concrete block or brick foundations, the termiticide must be pressure-injected through drill holes into foundation walls. Extensive drilling and pressure injection are often necessary in slab foundations as well as under earth-filled porches, around fireplaces and along adjacent patios and sidewalks. There are several termiticide products registered for these uses, and the label directions must be carefully followed.

Termites attempting to tunnel into an insecticide treated area will be either killed or repelled. Repellent termiticides do not kill termites, they turn them away. This may allow some termites to avoid treated areas, then locate and use gaps in the treated zone. Repellent termiticides provide immediate protection for the structure, and maintain protection for up to 5 years. Currently available repellent termiticides include deltamethrin (Suspend® SC), permethrin (Dragnet® FT, Prelude®), cypermethrin (Previal® FT, Demon® TC), and bifenthrin (Talstar®).

Some current insecticides being used for termite control are considered nonrepellent (lethal) to termites when applied at standard use rates. These insecticides do not repel, but kill the termites directly, as they tunnel through the treated area. Lethal insecticides include imidacloprid (Premise®), fipronil (Termidor®), and chlorfenapyr (Phantom®) and thiamethoxam. These nonrepellent termiticides provide approximately 5 years of protection and are usually effective within a few days.

Foam treatments. In some situations, liquid termiticides fail to reach termites or their foraging tubes. In void areas in walls, around fire

places, under slabs or in soil-filled porches, for example, liquid termiticides may not reach termites on vertical or elevated surfaces. Foam versions of insecticides can fill void areas and reach these difficult locations. Foam applications require specialized equipment and added surfactants and may not be available through all termite control companies.

Foams are not well suited for treating soil directly. Liquids can penetrate soil more effectively and should be used principally to treat most homes. Foams, however, are useful in successfully treating void areas where liquid termiticides are ineffective.

Some pest management companies offer borates for termite prevention and control. These inorganic termiticides can be effective when used according to label directions but are more effective when used in conjunction with other treatments.

Inaccessible soil beneath a structure can limit the effectiveness of soil-applied liquid termiticides. In homes that have crawl spaces with limited access, for example, it may not be possible to treat all possible termite entry points. In other homes, termites may be entering through an unusual location, where termiticides are not normally applied. In such cases termite baits may be a useful alternative to liquid termiticides, or they can be used as a supplemental treatment.

Baiting treatments: Since the mid-1990s, termite control baits have been available as an alternative to soil-applied liquid termiticides. Today's termite control providers may offer

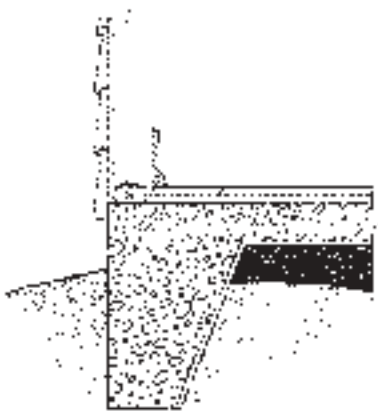


Figure 8. Slab house must be completely insulated from the ground by treated soil.

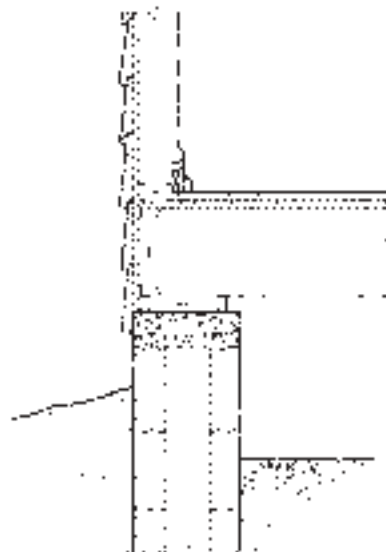


Figure 9. Crawl space houses are treated only around the foundations and piers.

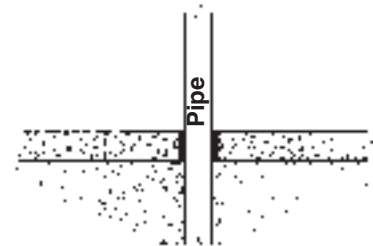


Figure 10. Pipes and utility lines entering through walls and slabs are heavily treated.

several choices of baiting systems.

This method takes advantage of termite food sharing behavior to introduce an insecticide into the colony. Worker termites feed on termite baits and carry the digested cellulose and termiticide back to the colony where they regurgitate their stomach contents to feed other termites. This sustains the queen, brood and other less mobile worker termites. Rather than keeping termites from entering a structure, baits are designed to suppress termite colonies so that they are incapable of feeding on the structure.

Baiting technology requires that the technician be familiar with termite biology and behavior and diligently monitor the bait stations. Some baiting systems are advertised as "stand alone" treatments for termite control; others are used in combination with liquid termiticide applications. Control can take several months to more than a year. Using bait for controlling termites has advantages and disadvantages over liquid termiticides.

Disadvantages include:

- The amount of time needed to stop the termite feeding on a structure. (Termites may not quickly find and ingest the bait).
- They affect only termites that feed on the baits or receive the termiticide through shared feeding.
- They provide no residual protection for a structure. Once discontinued, termites will return and feed on the structure unless conducive conditions are eliminated.
- Not all baits have been thoroughly tested for effectiveness.

Advantages of baits are that they:

- Eliminate the need for drilling holes into slabs, sidewalks and patios.

- Use less insecticide than liquid treatments.
- Allow occupants to stay home during their application.

Before purchasing a baiting treatment, ask the termite control professional for documentation of the effectiveness of the bait product. You should also clearly understand the time required for effective control and the costs associated with monitoring and treating with termite baits as stated in the contract.

Other termites: The treatments discussed in this publication are for subterranean termites. Drywood termites must be treated by removing infested wood, using spot treatments or by fumigation. For more on identification and control of drywood termites, see E-366, "Drywood Termites." Formosan subterranean termites may also require different control techniques. For more information, see E-367, "Formosan Subterranean Termites."

Do-it-yourself termite control: Termite treatment requires specialized drills, pressure injectors, pressure-generating pumps and high capacity tanks. It is advisable, in most cases, to use pest control specialists as they are familiar with construction principles and practices, have the necessary equipment and know termite biology and habits. The Texas Structural Pest Control Board licenses and certifies these professionals for competence in treatment procedures that provide safe and effective control. For more information on how to choose a pest management professional to treat your home, see E-369, "How to Select a Termite Control Service."

The USER is always responsible for the effects of pesticide residues on livestock and crops, as well as problems that could arise from contamination of neighboring property. Always read and follow carefully the instructions on the container label.

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