


Subterranean Termites



— Roger E. Gold, Kimberly M. Schofield, Elizabeth Brown, and Molly Keck*

ubterranean termites are some of the most destructive insect pests of wood in the world. They cause billions of dollars in damage each year and can severely damage a family's most valuable possession—their home. There are several hundred species of termites in these major family groups: Rhinotermitidae (subterranean), Kalotermitidae (dry-wood), Termopsidae (dampwood), and Termitidae (agricultural). Most species in these families are tropical or subtropical, and Texas is an excellent place to find them.

All termites feed on the cellulose found in wood and grasses. In nature, subterranean termites are beneficial because they break down the cellulose in wood into usable nutrients and recycle the carbon in wood to produce humus, which enriches the soil. Therefore, termites are extremely important in the ecosystem.

Problems occur when termites attack the wooden elements of homes and other structures. The presence of termites is often not apparent 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 termite damage, it is helpful to be able to identify them, know something about their life cycle, be able to recognize signs of infestation, and know about preventive and control measures.

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Distribution

Subterranean termites are found in every state except Alaska. The two major types in Texas are the native subterranean termite (*Reticulitermes flavipes*) and the Formosan subterranean termite (*Coptotermes formosanus*). Both are serious threats to wooden structures. (For more information about the Formosan subterranean termite, see Extension publication E-367, available at <http://AgriLifeBookstore.org>).

The major termite populations are in the coastal areas of Texas, but they are found throughout the state. Several problem species, including the Formosan termite, are moving to the north. They can spread easily when infested wooden products are recycled for use as landscaping timbers or retaining walls. In Texas, subterranean termites cause about \$500 million in damage each year. If a home is not protected, there is about a 70 percent probability that it will suffer some termite damage within 25 years.

Identification

Termites are in an Order of insects called Isoptera, which literally means “equal wings.” Their two sets of wings are the same size and shape, which is unusual among insects. Only the adult reproductives, known as “swarmers,” have wings (Fig. 1). The female primary reproductives are queens and the males are



Figure 1. Reproductive subterranean termites, known as swarmers.

kings. Swarmers are about $\frac{3}{8}$ inch long and are usually active in the early spring. Both the queens and kings go through the swarming process as they leave old colonies to form new ones. Swarmers (alates) are identified by the general size and color of the body, the translucent (clear) wings, the patterns of the veins in the wings, and the time of year when swarming occurs.

If identification is in doubt, the termites should be submitted for identification to the Center for Urban and Structural Entomology, 2143 TAMU, College Station, Texas 77843-2143. When sending swarmers for identification, they must be put in a vial with 70% alcohol to keep them from dehydrating and to keep the wings intact. Additional information can be found at <http://urbanentomology.tamu.edu>, or call (979) 845-5855.

The other termite caste used to identify a species is the soldier caste. Soldiers have enlarged heads with protruding mouthparts (mandibles) that are used to defend the colony from invaders (Fig. 2). There are approxi-



Figure 2. Soldier of a native subterranean termite.

mately equal numbers of female and male soldiers in a colony, but they are not thought to be involved in reproduction. The shape of the head and the size and configuration of the teeth on the mandibles are important for species identification.

The immature castes (Fig. 3) of native subterranean termites include the larvae, workers and nymphs. They are generally not used in identification because it is difficult to differentiate the various termite species at these stages of the life cycle. Depending on the age and development, these individuals will vary from $\frac{1}{16}$ to $\frac{1}{4}$ inch in length.

Termites often swarm at about the same time as some species of ants, and the two types of insects are sometimes confused. Most ant species are not wood-destroying insects, so it is necessary to distinguish them from termites. Figure 4 illustrates some of the differences between these two groups of insects.



Figure 3. Worker caste (pseudergates) of native subterranean termites.

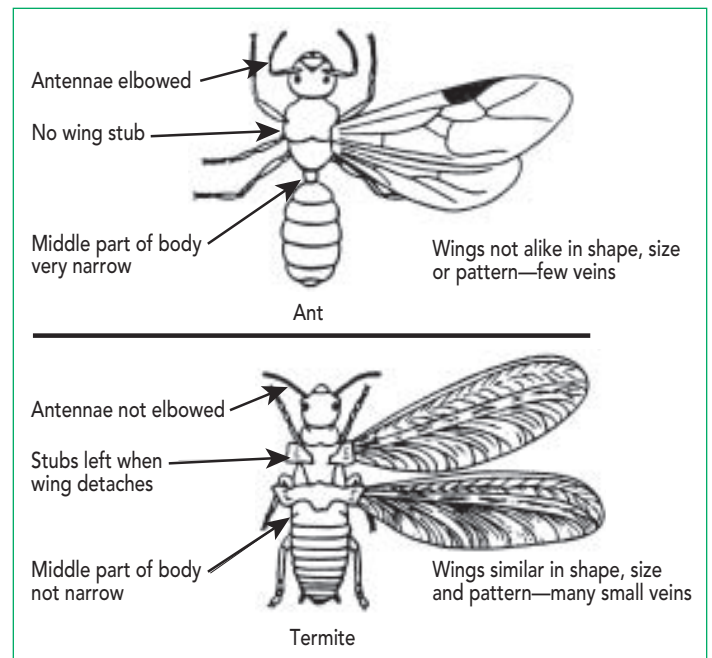


Figure 4. Differences between ants (top) and subterranean termites (bottom).

Biology

New colonies of termites are started when reproductives swarming from existing colonies find new nest sites near wood that is in contact with the soil. The swarming queens and kings find each other by using odors known as pheromones. A pair sheds their wings, digs a nuptial chamber in moist soil near wood, and mates. After about a week, the queen begins to lay fertilized eggs, which hatch after several days. During the first year, the queen will lay only a few hundred eggs. As the young queen grows larger, she lays more eggs. The king takes care of the eggs by keeping them clean and moist. As the larvae hatch from the eggs, he provides digested cellulose to feed them. The queen does not lay all her eggs at once, but continuously, so that the colony grows in size and number.

Larvae molt three or four times and become pseudergates; some of these become workers, while others develop into soldiers or nymphs. The workers maintain the colony structure by foraging for sources of wood, digging tunnels, and building mud tubes to protect the other termites. It is the worker caste that damages wood and slowly destroys structures. The development of a termite colony is depicted in Figure 5.

After 3 to 5 years, a native subterranean termite colony is mature, usually has about 250,000 workers (though some colonies remain small), and begins to produce swarmers. Then the cycle is repeated. Several termite colonies may live near each other and attack the same structure.

Termite swarmers (primary reproductives) leave the colony in large numbers during the spring and early summer. Swarming begins in South Texas in January

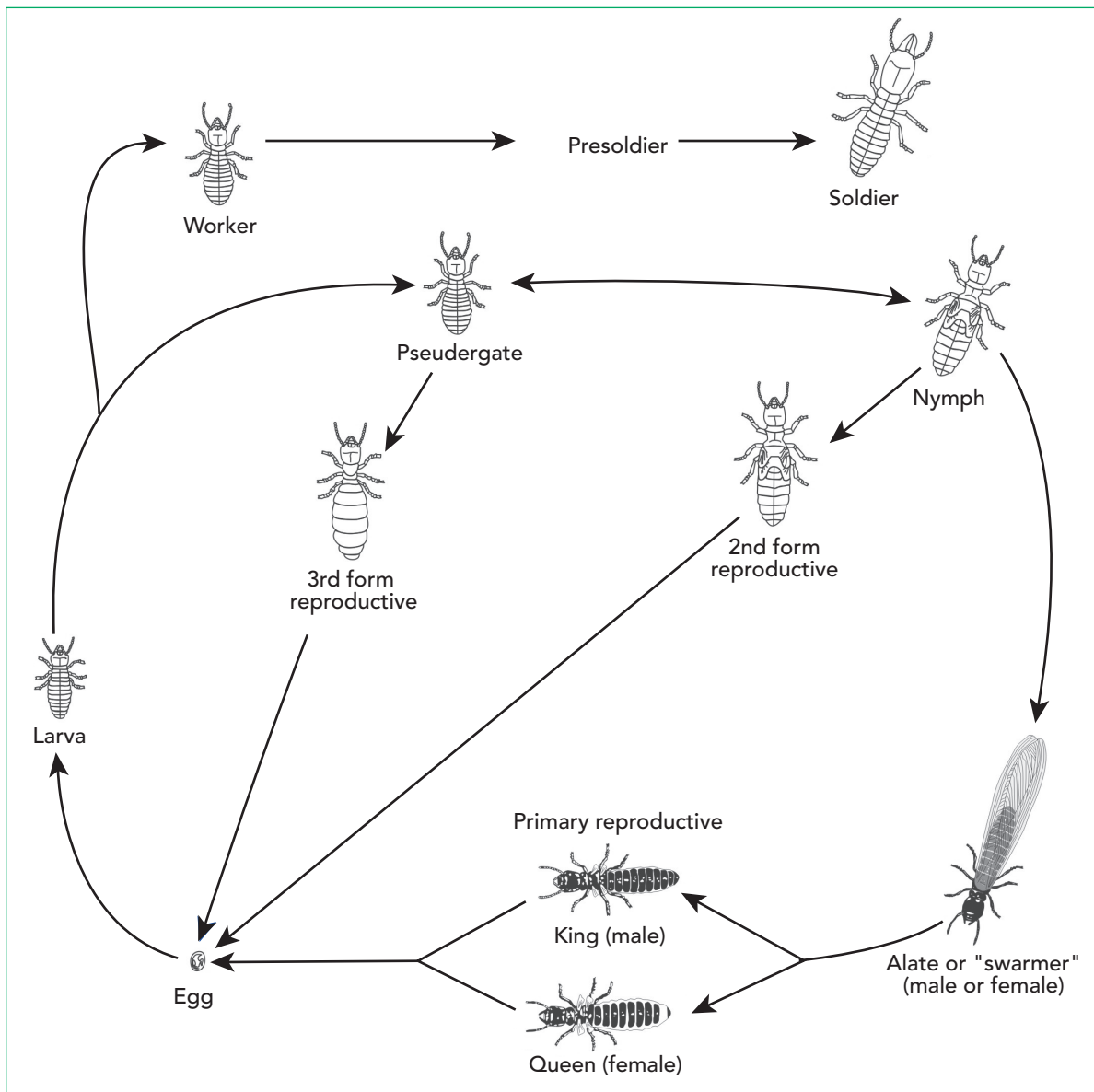


Figure 5. A summary of the life cycle of native subterranean termites (*Reticulitermes*).

and February, but in the Panhandle region of Texas, swarms do not occur until April or May. Environmental factors such as heat, day length, and moisture trigger the emergence of swarmers. Each species has its own set of requirements. The number of swarmers produced is proportional to the age and size of the colony. A new colony can form without swarming if a group of termites becomes isolated from the main colony and establishes a sub-colony. This is called “colony splitting” or “budding.” A sub-colony may remain independent or reunite later with the main colony.

In addition to the primary reproductives—queens and kings, which are generally dark brown or black—there are also secondary and tertiary reproductives (Fig. 5), also known as supplemental reproductives. These are actually worker termites that can mature sexually and mate if they are isolated from the main colony or if the primary queen dies or can no longer reproduce. Secondary reproductives are nymphs with wing buds on the outside of the body but no wings. Tertiary reproductives lack both the wing buds and wings. Both secondary and tertiary reproductives are pale yellow-brown and do not leave the colony. When supplemental reproduction occurs, there may be several queens that lay fertile eggs. As a result, the colony grows faster than if the primary queen had survived.

Termite workers make up the largest number of individuals within a colony and do all the work. They are blind, wingless, white to creamy white, and $\frac{1}{4}$ to $\frac{3}{8}$ inch long (Fig. 3).

Soldiers resemble workers in color and general appearance but have well-developed brownish heads with strong mandibles or jaws (Fig. 2). Soldiers defend the colony against invaders, primarily ants and other termites. They cannot forage for food or feed themselves and depend on the workers to feed them. Because the soldiers are expensive for the colony to maintain, they make up only 1 to 5 percent of the total population. After spring swarms, there are too many soldiers in the colony, and the workers kill and eat the excess soldiers to reduce their number. A large number of soldier head capsules, which are not eaten, will be left in the colony.

The maximum size of a termite colony depends on location, food availability, and environmental conditions, especially temperature and moisture. Subterranean termites get their nutrition from wood and other material that contains cellulose, such as paper, cotton, burlap or other plant products. Sometimes termites 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 it. Workers share digested cellulose with developing larvae, other workers, soldiers, and reproductives.

Termites are attracted to certain odors of wood. Decaying fungi make the wood more palatable and easier to penetrate. Some fungi and bacteria also provide a source of nitrogen in the termite diet.

Moisture is important to subterranean termites because they become dehydrated easily. To survive, termites must maintain contact with the soil (their primary moisture source) or other moisture sources, such as defective plumbing, leaky roofs, leaks from air conditioning condensers, or poorly maintained gutters. In the past, it was believed that subterranean termites had to return to the soil often; now we know that if moisture is available, termites can be away from the soil for extended times.

Subterranean termites also must protect themselves from temperature extremes and attack by ants and other insects. Worker termites that forage for food above ground protect themselves with shelter tubes or mud tubes (Figs. 6 and 7) made from particles of soil or wood and bits of debris held together by salivary and fecal secretions. Some mud tubes are thinly constructed and some are large with thick walls to accommodate termites moving vertically between the soil and their food source. Shelter tubes are often used to bridge across masonry or other objects so that termites can get to wood inside structures. Subterranean termites also transport moist soil into the structures they infest. The presence of shelter tubes and mud within galleries indicates an active infestation.



Figure 6. Subterranean termite shelter tubes on foundation wall.

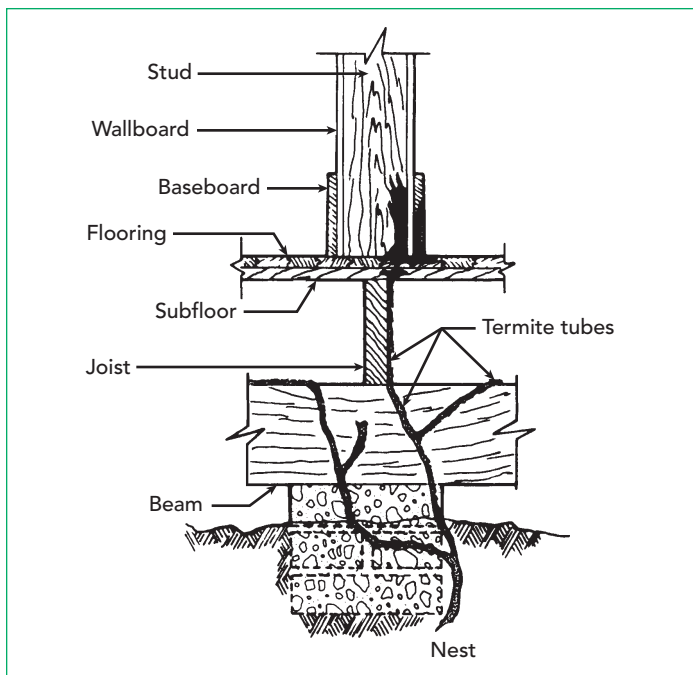


Figure 7. Typical termite shelter tubes.

Damage

Dead trees and brush are a natural food source for foraging subterranean termites. Thus, subterranean termites are usually found in the top 4 to 6 inches of the soil to take advantage of dead wood falling to the ground. When natural vegetation is cleared and structures are built, termites often switch to feeding on the wooden components of 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 grade stakes not removed after construction, can serve as an avenue for foraging workers.

Signs of infestation

Active termite infestations can be difficult to detect so homes should be inspected regularly. Signs of infestation include the wings or bodies of swarmers on window sills, mud tubes on outside walls, and damaged wood inside or around a structure.

Swarmers: Generally, the first sign of infestation homeowners notice is swarming reproductives or wings on windowsills, in spider webs, or near indoor lights (Fig. 1). Swarming termites inside a house usually indicate an active infestation in the structure. Finding swarmers outdoors indicates that termites are present and may be attacking nearby structures.

Mud tubes: Mud shelter tubes on crawl space piers, near utility openings, 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 an inspection easier, vegetation should be pruned away from house walls. The soil line should be several inches below the top of the slab or foundation wall. An inspector should look carefully for mud tubes along foundation walls and slabs, especially along cracks and in corners, or where the top of the foundation is close to the ground. Any mud tubes found should be broken open to check for live termites.

Damaged wood: Wood damage may not be found at first, but it confirms a current or past termite infestation. Wherever wood comes in contact with the soil there is a high risk for termite infestation. Wood should be struck with a screwdriver or hammer; if there is a dull, thudding sound, the wood may be damaged. Probing suspected areas with a sharp instrument such as a screwdriver or an ice pick will often disclose termite galleries or damage. It is virtually impossible to determine the age of wood damage, which is an important point because some termite control contracts specify that the pest control service is responsible only for “new damage.”

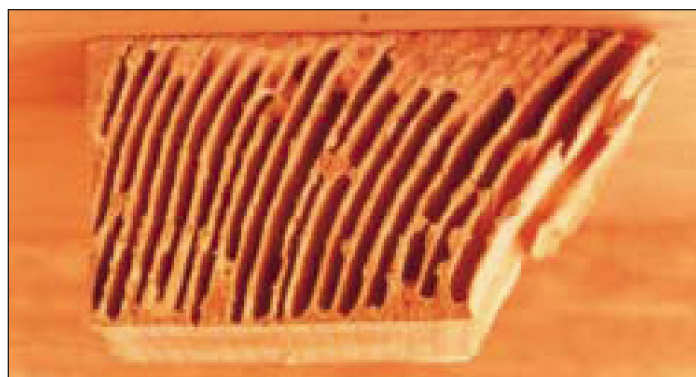


Figure 8. Typical wood damage by subterranean termites.

Subterranean termite damage is usually confined to the soft, spring growth of wood (Fig. 8). Termite tunnels and galleries tend to follow the wood grain and are lined with mud or may have a pale, spotted appearance from soft fecal material plastered on tunnel surfaces. Moisture may cause wood decay and can encourage subterranean termite infestation. Deterioration caused by wood-destroying fungi can be confused with termite damage.

For information about other insects that damage wood, see these Extension publications (available at <http://AgriLifeBookstore.org>): “Drywood Termites” (E-366), “Carpenter Ants” (E-412), “Carpenter Bees” (L-1826), and “Structure Infesting Wood-Boring Beetles” (E-394).

Management

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

Inspections

Although a homeowner or property manager can perform an inspection, it is recommended that licensed professional inspectors do this work because they have the necessary training and experience. Inspectors should be familiar with termite biology and habits, as well as construction methods and conditions that are conducive to termite infestation. Pest management professionals can determine the presence of infestations and damage, the need for remedial control measures, and the procedures needed to eliminate the conditions that encourage termite attacks. Texas law requires that inspectors complete a Wood Destroying Insect (WDI) report with each formal inspection and treatment for termites. They must also place a sticker under the kitchen sink or on the electrical box or water heater to document the name of the company, date, and outcome of the inspection.

Tools and equipment needed for an inspection may include a flashlight, ice pick or sharp-pointed screwdriver, ladder, and protective clothing (bump cap, coveralls, and rubber knee pads). A clipboard with graph paper and a floor plan/sketch are used to document the findings of the inspection and ensure that the entire structure has been examined. A moisture meter can detect moisture in walls that might indicate conducive conditions, the presence of termite shelter tubes, or hidden nests. Termite inspectors may also use fiber optic boroscopes, acoustical detectors, motion detectors, X-ray technologies, infra-red cameras, and methane or CO₂ detectors. This equipment can be useful, but does not guarantee the detection of all termites or their damage to a structure. Some inspectors use specially trained dogs to help find infested areas.

Outside, professional inspectors should:

- Examine the foundation of the house, garage and other structures for shelter tubes coming from the soil (Figs. 4a and 4b). 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,

sidewalks, 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 doorframes 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 wall, a common point for infestation.
- Carefully inspect wood materials next to swimming pools that may be splashed frequently by water.

Inside, inspectors should:

- Probe or carefully sound exterior porches, door and window facings, baseboards, and hardwood flooring, being careful not to deface finished wood.
- Check for unusual moisture levels and signs of infestation around earth-filled porches or other termite-prone features. Check ceilings for water damage (conducive 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, particularly in bathrooms on slab construction. **If there is no access to the bath trap area, a removable plumbing hatch should be installed. It is important to periodically check the bath trap area 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. 9). Examine the insides of

the beams, chimney bases, hearths, and 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, action should be taken to remove it.
- 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 or foundation walls.

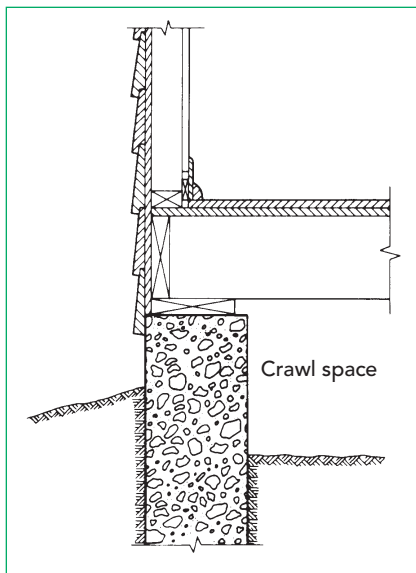


Figure 9. Construction showing crawl space.

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. For existing homes, lots may need to be regraded or buried drain lines may need to be installed. Soil-filled porches, patios, sidewalks or breezeways should slope away from the house.

Soil-filled 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 elements 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 termites from constructing shelter tubes over the foundation, but it does make visual inspection easier.

Shrubby and dense foliage should not be planted close to the house because this increases humidity and hinders the inspection of the foundation line.

At least 70 percent of the crawl space soil under pier and beam structures should be covered with a 6-mil polyethylene water barrier. This helps prevent moisture build-up in the subflooring. Place exterior foundation wall vents opposite each other and close enough to the corners of the foundation to provide cross 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. Dehumidifiers designed for crawl spaces and basements will help dry them out and discourage termites.

Wood that is exposed to rain (for example, sill plates) or is in contact with the soil should be pressure treated with preservatives. Wood porches, steps, and stair carriages should be set on solid concrete bases to separate them from the soil by at least 6 inches. Seal and caulk all foundation openings where plumbing and service utilities enter the structure. 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 can be used for long-term termite proofing of new homes. This material is normally installed on top of the soil and around plumbing penetrations before the slab is poured. This will prevent subterranean termites from 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 entire 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.

Pre-construction treatments. Treating all the soil under a structure with a termiticide before the slab is poured can protect it for several years. This may eliminate the need for drilling injection holes through the slab at a later date. Insist that the contractor or architect specify that a pre-construction application of termiticide be applied to all of the soil before the slab is poured and not just to the plumbing penetrations. In addition, the outside perimeter should be trenched and treated after the final soil grade is established. A liquid termiticide should be used, at the full label rate, rather than a bait product, which is less effective. This is the one time in the life of a structure when the soil beneath the slab can be protected against termites.

Post-construction treatments. For treating existing homes, a termiticide should be applied to the soil inside and outside foundation walls, around piers or other supports, and around utility entrances (Fig. 10). With 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. Areas under earth-filled porches, around fireplaces, and along adjacent patios and sidewalks also must be treated. Termiticide label directions must be carefully followed.

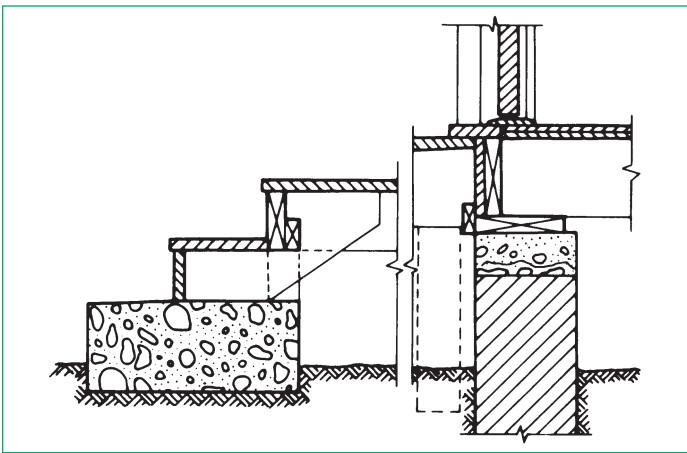


Figure 10. Removing wood-to-soil contact to prevent termite entry.

Once a structure is treated properly, termites attempting to tunnel into a treated area are either killed or repelled. Repellent termiticides do not kill termites, but turn them away. Some termites may 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. Some insecticides kill termites as they tunnel through the treated area. These

lethal termiticides provide approximately 5 years of protection and are usually effective within a few days. For more information on termiticides visit <http://urbanentomology.tamu.edu>.

Types of chemicals

Liquid termiticides. Liquids can penetrate soil more effectively than other insecticide formulations and should be the primary product used to treat most homes.

Foam treatments. Liquid termiticides may not reach termites or their foraging tubes in some spaces or on vertical or elevated surfaces. In wall voids, around fire places, under slabs, or in soil-filled porches, it may be better to use foam versions of insecticides. Foam 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.

Borates. Some pest management companies offer borates for termite prevention and control. These inorganic pesticides can be effective when used according to label directions, but are more effective when used in conjunction with other treatments. While borates do penetrate into wood, that penetration may not be sufficient to protect the core of the lumber.

Baiting treatments. Where the soil beneath a structure is inaccessible or crawl spaces have limited access, or where termites are entering through an unusual location, termiticides are not normally applied. In these situations, baits may be a useful alternative or supplement to liquid termiticides. Termite control services may offer several choices of baiting systems.

Baits take advantage of the fact that worker termites take ingested food back to the colony to feed other termites. Rather than keeping termites from entering a structure, baits are designed to suppress termite colonies. 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. Baits have both advantages and disadvantages over liquid termiticides.

Disadvantages:

- Baits take much longer to have an effect because termites may not quickly find and ingest the bait.
- Baits are effective only if termites feed on them and then share them with the colony.

- Baits provide no residual protection for a structure. Once baits are discontinued, termites will return to feed on the structure unless conducive conditions are eliminated.

Advantages:

- Baits eliminate the need for drilling holes into slabs, sidewalks and patios.
- They use significantly less insecticide than normal liquid termiticide treatments.
- They allow residents to stay home during insecticide 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 applying and monitoring termite baits, as stated in the contract.

Do-it-yourself termite control. Termite treatment requires specialized drills, pressure injectors, pressure-generating pumps, and high-capacity tanks. It is usually best to have this work done by pest control specialists who are familiar with construction principles and practices, have the necessary equipment, and know termite biology and habits. The Texas Department of Agriculture Structural Pest Control Service licenses and certifies these professionals for competence in using effective treatment procedures. For more information on how to choose a pest management professional to treat your home, see “How to Select a Termite Control Service” (E-369), available at <http://AgriLifeBookstore.org>.

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

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Revision