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Subterranean Termites

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Subterranean 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 families: Rhinotermitidae (subterranean), Kalotermitidae (drywood), Termopsidae (dampwood), and Termitidae (agricultural). Most species in these families are tropical or subtropical, and Texas is home to many of them.

All termites feed on the cellulose found in wood and grasses. In nature, subterranean termites are important decomposers. They are considered beneficial because they break down cellulose in wood into usable nutrients and recycle carbon in wood to produce humus, which enriches 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 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 most economically important species in Texas are the eastern subterranean termite (*Reticulitermes flavipes*) and the Formosan subterranean termite (*Coptotermes formosanus*). Both are serious threats to wooden structures.

The major termite populations in Texas are in the coastal areas, but termites are found throughout the state. The invasive Formosan termite continues to expand its range in Texas and can now be found in more than 30 Texas counties. They can spread easily when infested wooden products are recycled for use as landscaping timbers or as retaining walls. In Texas, subterranean termites cause about $500 million in damage each year. If a home is not protected, the probability that it will suffer some termite damage within 25 years is very high.

Identification

Termites are in an order of insects called Blattodea, and belong to the infraorder "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 commonly as "swarmers," have wings (Fig. 1). The female primary reproductives are queens and the males are kings. Swarmers are about ⅜ 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 (also known as alates) are identified by the general size and color of the body, the clear wings, the patterns of the veins in the wings, and the time of year when swarming occurs.

Figure 1. Reproductive subterranean termites, known as swarmers.

If you are unsure about identification, termites should be submitted for identification to the Rollins Urban and Structural Entomology Facility. Mail swarmer samples to 2556 F and B Rd, College Station, Texas 77843-2143. When sending swarmers for identification, they must be placed in a leak-proof container with 70 percent 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 approximately equal numbers of female and male soldiers in a colony. The shape of the head, and the size and configuration of the teeth on the mandibles are important for species identification.

Figure 2. Soldier of a native subterranean termite.

The remaining castes (Fig. 3) of native subterranean termites include the larvae, workers, and nymphs. They are generally not used in identification because it is difficult (or impossible) to differentiate the various termite species using these castes. Depending on the species, age, and development, these individuals will vary from 1⁄16 to ¼ 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 of native subterranean termites.

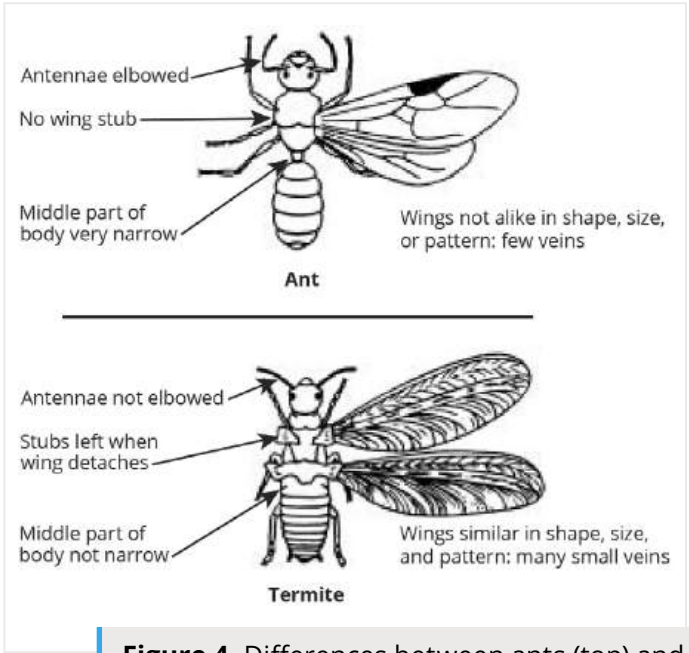

Figure 4. Differences between ants (top) and subterranean termites (bottom).

Biology

New colonies of termites are started when reproductives swarming from existing colonies find new nest sites near wood that is in contact with soil. The swarming queens and kings find each other by using odors known as pheromones. Once on the ground, the pair shed their wings, dig a nuptial chamber in moist soil near wood, and mate. 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 steadily grows.

Larvae molt three or four times, and some become workers while others develop into soldiers or nymphs (nymphs will eventually become the next generation of swarmers). The workers maintain the colony structure by foraging for sources of wood, digging tunnels, and building shelter 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, can contain as many as 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 and February. In the Panhandle region of Texas, swarms do not occur until April or May. Environmental factors such as temperature, 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, 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. When supplemental reproduction occurs, there may be several queens that lay fertile eggs.

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 ¼ to ⅜ inch long (Fig. 3).

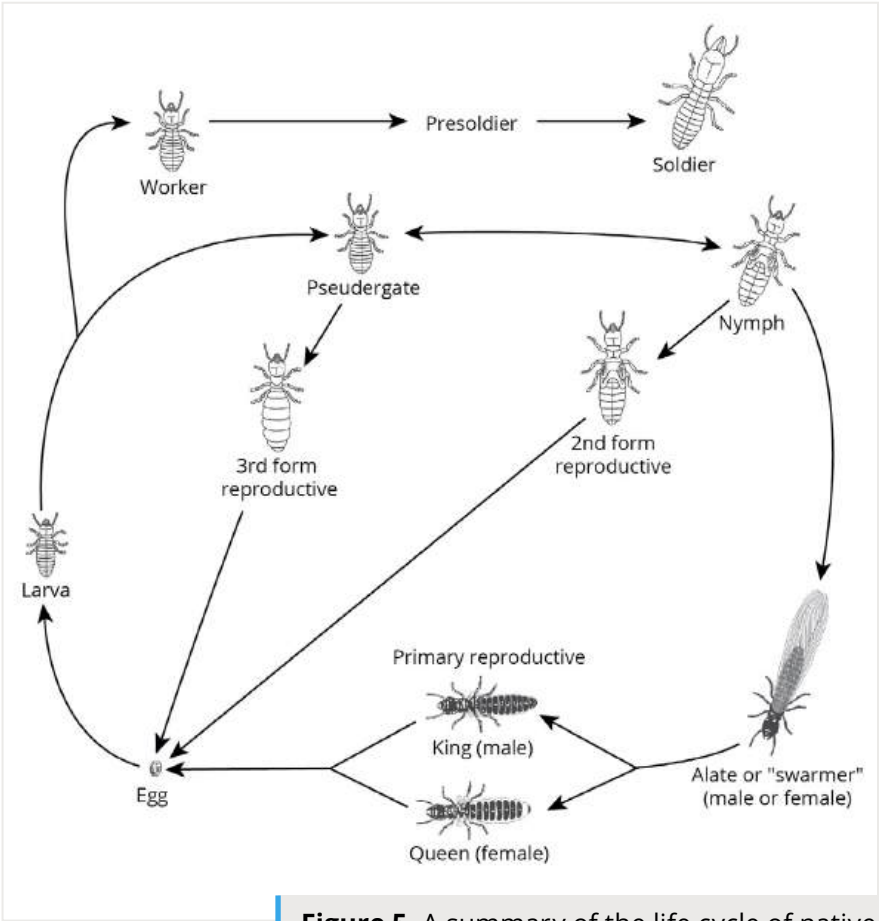

Figure 5. A summary of the life cycle of native subterranean termites (*Reticulitermes* species).

Soldiers resemble workers in color and general appearance but have hardened 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 biologically expensive for the colony to maintain, they make up only one to five 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. Many 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 materials that contain cellulose, such as paper, cotton, burlap, or other plant products. Many 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.

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 exist away from the soil for extended times.

Subterranean termites must also 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). These are made from particles of soil or wood and bits of debris held together by salivary and fecal secretions. Some mud tubes are thinly constructed, while 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 can indicate of an active infestation.

Figure 6. Subterranean termite shelter tubes on foundation wall.

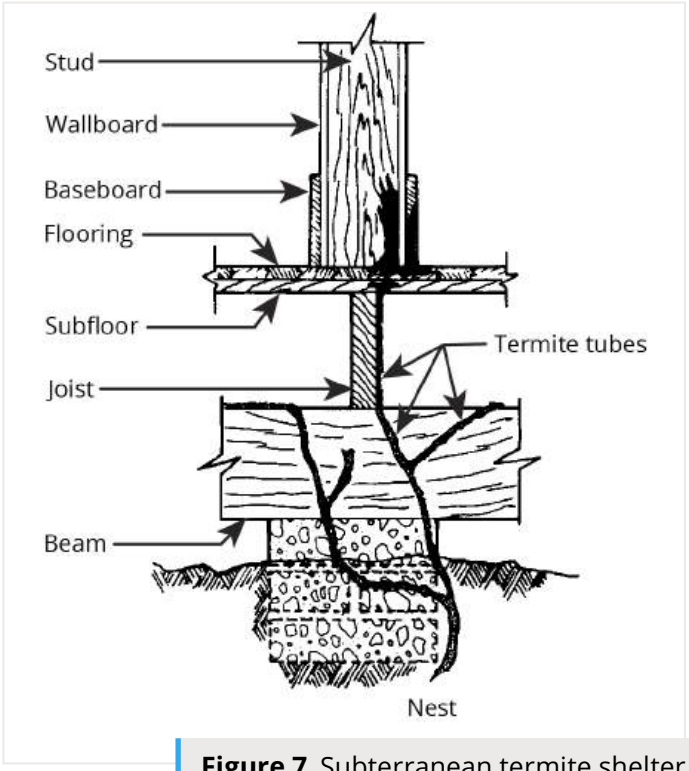

Figure 7. Subterranean termite shelter tubes gaining entry into a structure.

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 that has fallen to the ground. When natural vegetation is cleared and structures are built, termites often switch to feeding on 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 soil, such as trees, vines, or grade stakes not removed after construction, can attract foraging workers.

Signs of Infestation

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

Swarmers

Generally, the first sign of infestation that 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 inside the structure.

Shelter Tubes

Earthen 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 exterior 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 active termites.

Damaged Wood

If found, wood damage confirms a current or past termite infestation. It is virtually impossible to determine the age of wood damage. This is an important point because some termite control contracts specify that the pest control service is responsible only for "new damage." Wherever wood comes in contact with the soil there is a high risk for termite infestation.

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. The tunnels 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.

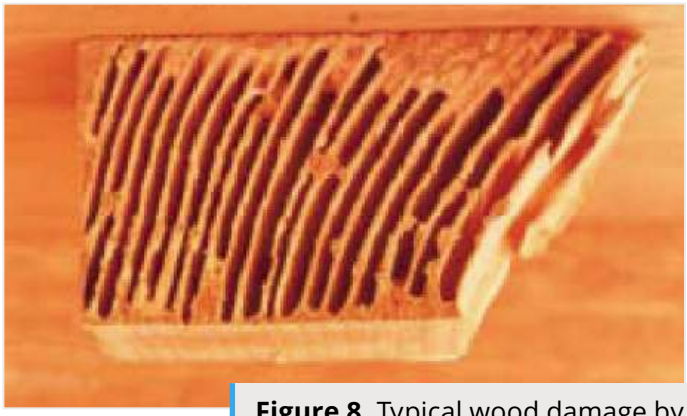

Figure 8. Typical wood damage by subterranean termites.

Management

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

Inspections

Although a homeowner or property manager can perform an inspection, it is recommended that a licensed pest management professional do this work. This is because they have the necessary training and experience required to confidently identify or

rule out a termite infestation. Inspectors should be familiar with termite biology and habits, as well as construction methods and conditions that are conducive to termite infestations. 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 infestations. Texas pest management regulations require that inspectors complete a Wood Destroying Insect (WDI) report with each formal inspection and treatment for termites. They must also place a decal 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 or treatment.

Tools and equipment needed for an inspection include a flashlight, ice pick or sharp-pointed screwdriver, ladder, and protective clothing (bump cap, coverall, and rubber knee pads). A floor plan/sketch will be made to document the findings of the inspection and ensure that the entire structure has been examined. A moisture meter can detect excessive moisture behind interior wall coverings, which might indicate conducive conditions for termite infestations. Termite inspectors may also use fiber optic boroscopes, acoustic detectors, motion detectors, and infrared cameras. 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 locate termite infestations to varying degrees of success.

On the exterior of the structure, professional inspectors should:

- Examine the foundation of the house, garage, and other associated structures for shelter tubes coming from the soil (Figs. 6 and 7). They should also take note of any cracks or foundation damage through which termites might enter.
- Note any places around the foundation where soil extends above the top of it. This includes built-in planter boxes with soil grades above the top of the foundation. Special attention should be paid to attached porches, connecting patios, sidewalks, areas near kitchens or bathrooms, and narrowly confined or hard-to-see places. Any portion of the structure where inspections cannot be made should be noted on the WDI report.
- 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, doorframes, and where utilities (i.e., 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 meters or fuse boxs set into the wall. These are common points 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. Be 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, expansion joints, and cold joints in the foundation. Also examine any unusual blistering in paint or wallboard surfaces. 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 access panel should be installed. It is important to periodically check the bath trap area for termite activity.**
- 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, called the 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 remedy the situation.
- Inspect carefully at the top of the foundation wall where the floor and the wall transition.
- Closely examine plumbing and utility lines passing through the floor or foundation walls for the presence of shelter tubes.

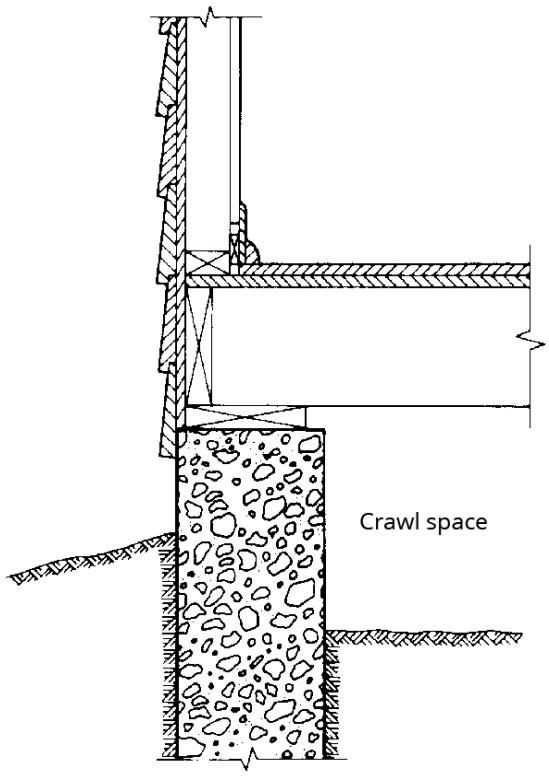

Figure 9. Crawl space construction.

Prevention

Many termite problems can be prevented through sound construction designs, mechanical alterations, and good construction sanitation. The basic premise behind prevention is to deny termites access to food (i.e., wood), moisture, and shelter. Planning before construction is vital. However, this is a task that construction workers and building designers implement. Pest management professionals can advise them on best practices and add-ons to existing structures. 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 a drainage system may need to be installed to shunt rain and/or irrigation water away from the structure. Soil-filled porches, patios, sidewalks or breezeways should slope away from the house. Eliminate all wood-to-soil contacts. 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 vertically up the foundation, but it does make visual inspection easier.

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 of 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-foot section 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 or is in contact with the soil should be treated with a protective finish. 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 after construction.

Stainless steel mesh or plastic sheeting can be used as a mechanical control 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 can help 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.

Chemical Management

Subterranean termites usually infest 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. Insist that the contractor or architect specify that a pre-construction application of termiticide be applied to all the soil before the slab is poured, 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. This is the one time in the life of a structure when the soil beneath the slab can be protected against termites without drilling through the foundation to apply liquid termiticides.

Post-construction Treatments

For treating existing structures, a termiticide should be applied to the soil inside and outside foundation walls, around piers and other supports, and around utility entrances (Fig. 10). Extensive drilling and pressurized injection of termiticides underneath concrete foundations is often necessary as well. Areas under earth-filled porches, around fireplaces, and along adjacent patios and sidewalks must also be treated. Termiticide label directions must be carefully followed.

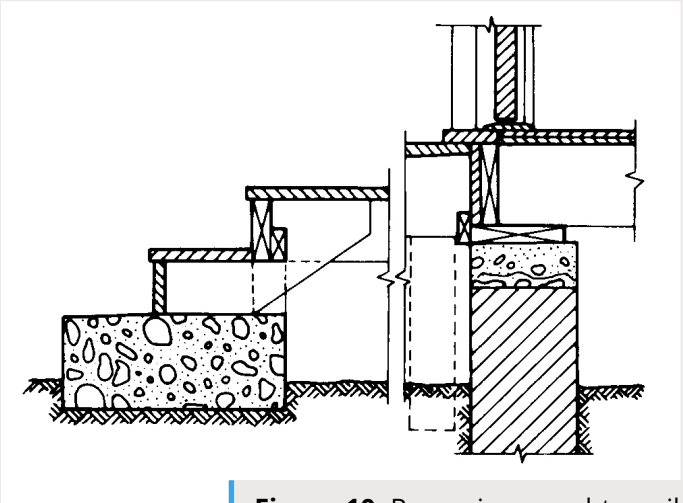

Figure 10. Removing wood-to-soil contact to prevent termite entry.

Once a structure is treated properly, termites attempting to tunnel into a treated area are either killed or repelled. Most modern termiticides kill termites as they tunnel through the treated area. These 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 Termiticides

Liquid Termiticides

Liquids can penetrate soil more effectively than other termiticide formulations and should be the primary family of products used to prevent or mitigate termite infestations.

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 porch cavities, it may be better to use foam versions of insecticides. Foam expands to fill void areas and carry termiticidal active ingredients to reach these difficult locations. Foam applications require specialized equipment and added surfactants, and may not be utilized by all termite management 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. These products are applied directly to exposed wood during or after construction. Borates are also commonly used to help control other wood-destroying insects.

Termiticidal Baits

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.

Termite baiting systems allow for the prevention and management of termites without reliance on the application of liquid termiticides in, on, or under structures. Modern termite baits consist of a cellulose matrix to which chitin synthesis inhibitors have been incorporated. Termite baits take advantage of the fact that worker termites take ingested food back to the colony to feed other termites. In doing so, the termiticidal active ingredient is efficiently shared with all castes within the colony. For this to work, the active ingredient needs to be slow-acting so there is enough time for it to be shared before killing the termites. Because of this, complete control may take several weeks. Baiting technology requires that the technician be familiar with termite biology and behavior, and that he or she diligently monitors the bait stations.

In-ground Bait Systems

In-ground bait stations consist of a perforated cylinder that allows foraging termites access to termiticidal baits therein. These stations are placed into the soil at consistent distances (5 to 10 feet apart from each other) around the structure to a depth such that the lid of the station is flush with the top of surrounding soil. This arrangement allows the pest management professional to inspect the baits for termite activity.

Above-ground Bait Systems

Several pesticide manufactures have developed and are marketing above-ground bait stations. These bait systems work in a similar way as in-ground bait stations. However, above-ground bait stations are offered directly to actively foraging termites within structures.

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 a pest management professional who is certified to engage in termite management. These professionals are also 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 competency in using effective treatment procedures.

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 properties. Always read and follow carefully the instructions on the container label. Using any pesticides in a manner inconsistent with label instructions is a violation of federal law.

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