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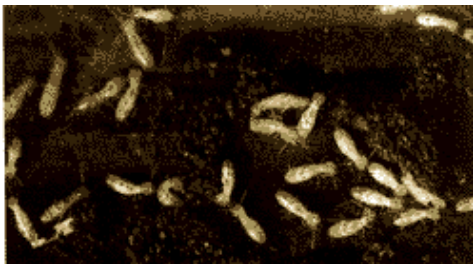
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Subterranean Termites and Their Control

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Termite damage to residential and commercial buildings in the U.S. costs more than \$1 billion annually. Subterranean termites, the most destructive of all termite species, account for 95% of the damage. Subterranean termites occur in every state except Alaska. Two subterranean termite species, *Reticulitermes flavipes* (Kollar) and *R. tibialis* Banks, are found in Nebraska. Control of these termites costs more than \$1 million each year.

Feeding Habits

Subterranean termites feed mainly on wood and wood products containing cellulose. Termites have protozoa (microorganisms) in their intestine which provide enzymes to digest cellulose. Although termites are soft-bodied insects, their hard, saw-toothed jaws work like shears and can bite off extremely small fragments of wood. These termites do not attack live trees.



Figure 1. Termite Damage.

Termites often infest buildings and cause damage to lumber, wood panels, flooring, sheetrock, wallpaper, plastics, paper products, and fabric made of plant fibers. Termites attack flooring, carpeting, art work, books, clothing, and furniture. The most serious damage involves the loss of structural strength.

Biology

Subterranean termites are ground-dwelling social insects living in colonies. The two species found in Nebraska have similar habitats. These termites have the ability to adjust the depth of their colony (nest) in soil depending on temperature and moisture requirements. The colony may be 18-20 feet deep in the ground. The ground serves as a protection against extreme temperatures and provides a moisture reservoir. Termites reach wood or cellulose materials above ground by constructing and travelling through earthen (mud) tubes. The mature colony consists of three castes: a) reproductives (king and queen), b) soldiers, and c) workers. It takes about 4 to 5 years for a colony to reach its maximum size and it may consist of 60,000 to 200,000 workers.



Reproductives: In spring and fall, the winged males and females emerge from their parent colonies to form new ones. This activity is called swarming. These winged reproductives are dark brown to brownish black and have two pair of nearly equal size semitransparent wings extending well beyond the body. The swarmers are weak flyers and, unless aided by wind, fly only short distances. Many of them are devoured by birds, spiders, ants, and other predators. Survivors return to the ground and shed their wings. The wingless males and females pair off (male following female in tandem) until they find a source of wood and moisture in the soil. They dig soil near wood, enter the chamber and seal the opening. After mating, the queen begins laying eggs. The royal queen is known to survive up to 25 years.



Eggs: The fertilized female usually deposits 6 to 20 eggs during the first six months following the swarming flight and she may lay more than 60,000 eggs in her lifetime. Eggs are yellowish white and hatch after an incubation period of 50 to 60 days.



Workers: The first brood of newly hatched nymphs (young termites) generally develop into workers. Full grown workers are soft-bodied, wingless, blind, and creamy white. In early stages, they are fed predigested food by the king and queen. Once workers are able to digest wood, they begin providing food for the entire colony. At this time, the king and queen cease feeding on wood. The workers undertake all the labor in the colony such as obtaining food, feeding other caste members and immatures, excavating wood for chambers, and constructing tunnels. Workers mature within a year and live from 3 to 5 years.



Soldiers: Soldiers are creamy white, soft-bodied, wingless, and blind. The head of the soldier is enormously elongated, brownish, hard, and equipped with two strong jaws. Soldiers must be fed by workers as they are incapable of feeding themselves. They are less numerous than workers and their sole function is to defend the colony against invaders such as ants. Soldiers mature within a year and live up to 5 years.

Figure 2. Subterranean Termite.

Difference Between Termites and Ants

Flying ants and swarming termites are often difficult to distinguish when these insects are seen around residential and commercial buildings.

Termites have relatively straight, beadlike antennae while ants have elbowed antennae. The termite has two pair of wings (front and back) that are of nearly equal length. The ant also has two pair of wings but of unequal size, the front wings much larger than the hind wings. The abdomen of the termite is broadly joined to the thorax while the abdomen and thorax of the ant are joined by a narrow waist called a petiole.

Communication in the Colony

1. Termites primarily communicate via chemicals called pheromones. Each colony develops its own characteristic odor. Any intruder is instantly recognized and an alarm pheromone is released that triggers the soldiers to attack the intruder. If a worker finds a new source of food, it recruits others to that food source by laying a chemical trail. The proportion of castes in the colony is also regulated chemically. Nymphs can develop into workers, soldiers, or reproductive adults, depending on colony needs.
2. Sound is another means of communication. Soldiers and workers can bang their heads against tunnel walls. The vibrations are perceived by other termites in the colony and serve to mobilize the colony to defend itself.
3. Mutual exchange of foods enhances recognition of colony members.

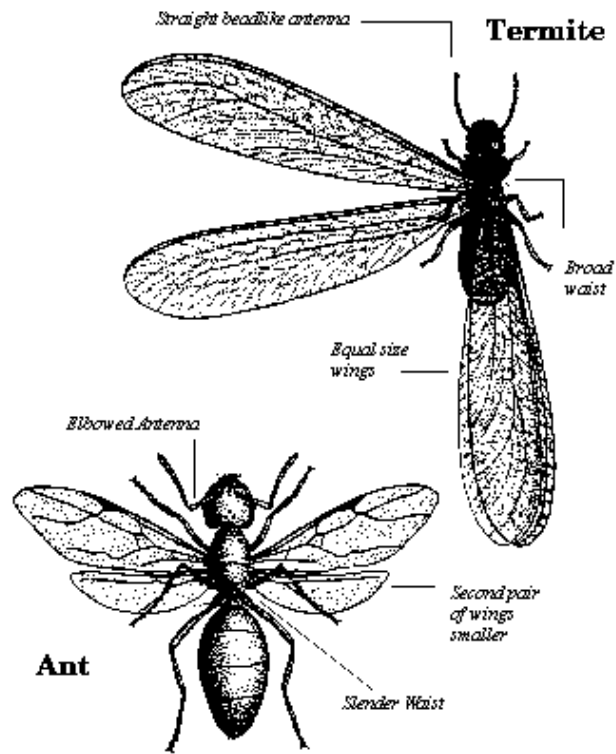
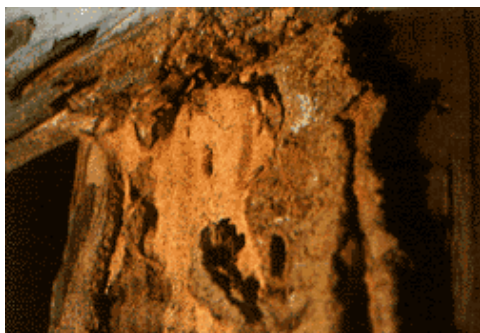


Figure 3. Termite and Ant.

Evidence of Termite Infestations



Wood damaged by subterranean termites can be readily penetrated with a screwdriver, ice pick, or knife. The wood easily breaks apart, revealing mud tubes attached to wood galleries or tunnels in an irregular pattern. The tunnels may contain broken mud particles with fecal materials. In the case of an active colony, white

Figure 4. Termite infested wood and mud tubes.

1. termites may be found in infested wood.
2. The presence of winged males, females, or their shed wings, particularly when the adults fly inside the building, indicates an infestation in the building.
3. Another indication is the presence of mud or shelter tubes extending from the ground to woodwork or on foundation walls. Workers travel periodically via shelter tubes to their colony to obtain moisture and

perform feeding duties. Workers build mud or shelter tubes from soil and wood particles, and coat them with a glue-like substance that they secrete. Each mud tube is about the diameter of a lead pencil.

How Old is the Damage?

Based on normal feeding activity, it takes 3 to 8 years to cause appreciable damage to a structure. There have been some predictions that, under ideal conditions, a termite colony of 60,000 workers may consume a one-foot length of 2" x 4" pine in 118 to 157 days. In Nebraska, the extent of damage may be less because of a reduction in feeding activity during the cold season.

Inspection for Subterranean Termites

Building owners/managers may be able to locate termite damage by probing wood with a screwdriver, ice pick, or knife. Start in the basement and use a bright flashlight. Look for mud tubes and the presence of swarmers. Termite damage/activity is often found during building remodeling or repair. Some agencies such as Farmers Home Administration (FHA), Veterans Administration (VA), Housing and Urban Development (HUD), and loan companies require termite inspections during real estate transfers. If necessary, seek help from professional pest control operators or experienced entomologists.

A professional should inspect exterior and interior foundation surfaces, particularly construction where wood is on or near the soil. Mud tubes are solid evidence of termite activity. Other inspection sites are:

1. Wood construction in basement and crawl space (if present.).
2. Sills, joists, support posts, basement window frames, wood under porches.
3. Hollow blocks, cracks in concrete or brick construction and expansion joints.
4. Scrap wood on ground, old tree stumps, fence posts, and exterior frames of basement windows.

A qualified inspector can provide information on whether the termites are active, how old is the damage and if chemical treatment is necessary.

Useful Information If Treatment is Necessary

If termite activity is suspected or found and an insecticide treatment is necessary, it is important to outline the plan of the building, indicating sites of termite activity and treatment procedures. Building owners/managers are encouraged to seek two or more inspections and cost estimates. Ask for information on chemical treatment procedures, repair of woodwork, warranties, copies of the insecticide label, and other pertinent information. Compare bids before making decisions. Ask for proof of liability insurance.

Control Objectives

The goal is to establish a continuous insecticide barrier between the termite colony (usually in the ground) and the wood in a building. Sometimes a secondary termite colony may exist above ground (in roof or other areas with a constant moisture supply) which requires additional treatment.

General Treatment Guidelines

Insecticide barriers are generally established during:

1. Pre-construction (during construction).
2. Post-construction (existing building). In an existing building, termite treatments may involve any of the

following: a) mechanical alterations, and b) use of an insecticide for treating the soil, foundation, and wood.

In most cases, an untrained homeowner or building manager should not attempt a termite treatment. Generally, termite treatments should be performed by professional pest control operators (PCOs). Termite treatment requires special tools such as hammer drills, sub-slab injectors, rodding devices, high pressure pumps, a power supply, protective equipment. Several insecticides are registered in Nebraska for termite control (Table 1). All of these insecticides control termites if properly applied. The procedures described here are general guidelines, and the applicator must follow the insecticide label directions for dilution, application rate, and other relevant information.

Caution

1. Do not apply insecticides when soil is frozen or water-soaked (saturated). Frozen or saturated soil will not permit adequate absorption for even distribution of insecticide.
2. Do not permit humans and pets to contact treated surfaces until dry.
3. Before using insecticides for termite control, always **read, understand and follow** all label directions.
4. Keep all pesticides in original containers, out of reach of children and do not contaminate food, feed and water.
5. Do not plant garden food crops in treated soil.
6. Do not allow children and pets to play in treated soil.

Pre-Construction Treatment

Horizontal Barriers: In general, treat the footing trench with insecticide before pouring cement footings. After grading is completed, apply diluted insecticide to areas before pouring slab floors, slab-supported porches, patios, carports, and entrance platforms at the rate of 1 gallon per 10 square feet.

Vertical Barriers: Establish a chemical barrier in areas such as around the bases of foundations, plumbing, utility entrances, and backfilled soil against foundation walls. Treat crawl space areas either by rodding or trenching procedures. To produce a vertical barrier in soil, apply insecticide at the rate of 4 gallons per 10 linear feet per foot of depth. After treatment, cover the crawl space area with a layer of untreated soil or polyethylene sheeting.

Post-Construction Treatment

Do not apply insecticides until locations of radiant heat pipes, water pipes, sewer lines, and electrical conduits are identified. Buildings requiring treatment generally fall into three categories: a) building on slab construction, b) building with crawl space, and c) building with a basement. There is a common belief that termites cannot penetrate slab foundations. Termites cannot penetrate solid concrete but they can enter through cracks as small as 1/64 of an inch.

Building on Slab

Controlling termite infestation in a building on a slab is especially difficult and hazardous. In this type of construction, heat ducts (pipes) are buried in the concrete and serious damage can occur when they are accidentally drilled for holes to inject insecticide solutions. Drilling through electrical conduits or plumbing imbedded in the floor is another problem. Treat the exterior of the foundation by digging a narrow and shallow trench about 6 inches wide along the outside of the foundation. Apply the diluted insecticide to the trench and soil at the rate of 4 gallons per 10 linear feet. Cover treated soil in the trench with a thin layer of untreated soil. For an inside barrier, drill slab and space holes about 1 foot apart and 6 inches from the wall.

Using a subslab injector, inject insecticide through holes at the rate of 4 gallons per 10 linear feet. After application, plug all holes with mortar or any other special compound.

Table 1. Insecticides registered in Nebraska for subterranean termite control			
<i>Brand or trade names</i>	<i>Generic or common names</i>	<i>Dilution rates</i>	<i>Manufacturers</i>
Available to professional pest control companies			
Demon TC	cypermethrin	0.25%	ICI Chemical Co.
Dragnet FT	permethrin	0.5-1%	FMC Chemical Co.
Dursban TC	chlorpyrifos	0.5-1%	Dow-Elanco Co.
Equity	chlorpyrifos	0.5-1%	Dow-Elanco Co.
Ficam ^a	bendiocarb	0.25%	Nor-Am Chem. Co.
Prevail FT ^b	cypermethrin	0.3-0.6%	FMC Chemical Co.
Pyrfon 6	isofenphos	0.75%	Mobay Chemical Co.
Torpedo	permethrin	0.5-1%	ICI Chemical Co.
Tribute	fenvalerate	0.5-1%	Roussel Bio Corp.
Available to general public			
Orthoklor Soil Insect & Termite Killer	chlorpyrifos	0.5%	Chevron Chem. Co.
Black Leaf Termite Killer	chlorpyrifos	0.5%	Black Leaf Products
Chlor-Guard Termite Preventor	chlorpyrifos	0.5%	Security Products
^a Registered for spot treatment only			
^b Registered for pre-construction treatment only			

Building With a Basement and Crawl Space

Basement: For an interior vertical barrier, drill the floor slab and space holes about one foot apart. Drilling may be required along the foundation walls, along one side of partition walls, along both sides of load-bearing wall, around sewer pipes, floor drains, conduits, and any crack in the basement floor. Using a sub-slab injector, inject the insecticide at the rate of 4 gallons per 10 linear feet.

For an insecticide barrier around the exterior of foundation walls, apply an insecticide by rodding and/or trenching. The rod holes should be spaced 1 to 1 1/2 feet apart to provide a continuous chemical barrier. If a trench is necessary, it should not be wider than 6 inches. Inject insecticide using rodding technique at the rate of 4 gallons per 10 linear feet. Cover the trench with untreated soil.

Crawl Spaces: Establish vertical barriers by rodding and/or trenching procedures. A shallow trench should not be wider than 6 inches. Space rod holes about 1 to 1 1/2 feet apart. Apply insecticide at the rate of 4 gallons per 10 linear feet per foot of depth. Do not treat soil in crawl space area with a broadcast insecticide spray.

Hollow Masonry Units of the Foundation Walls: Treat through masonry voids to provide a continuous chemical barrier at the top of the footing. When treatment is necessary, access holes must be drilled through mortar joints below the sill plate and as close as possible to the footing. Apply insecticide at the rate of 2

gallons per 10 linear feet. Plug all holes with mortar or any other special compound.

Bath Traps: Soil may require insecticide treatment if it is exposed beneath and around plumbing/waste pipe entrances through a concrete slab. Remove any wood or other debris and treat the soil by rodding or flooding with an insecticide solution.

Treatment Near Ponds, Wells, Cisterns, Faulty Foundation Walls, Around Pipes or Utility Lines: Insecticide applications through rodding is discouraged in such situations. The suggested procedure is to make a trench and remove the soil to be treated onto a heavy plastic sheeting or similar material. Treat the excavated soil with insecticide at the rate of 4 gallons per 10 linear feet per foot of depth. Mix the soil with insecticide and replace it in the trench. Cover the treated soil with a thin layer of untreated soil. In the case of wells, ponds, and cisterns, if a rodding technique is necessary, the distance between the treated area and the water source should be 50 feet or more.

Wood Treatment: In addition to soil treatment, it may be necessary to treat infested wood with insecticide spray or injection. Applications are made to inaccessible areas by drilling and then injecting the insecticide solution. Broadcast spray must be limited to wood in attics, crawl spaces and unfinished basements or similar unoccupied areas.

Treatment of Secondary Subterranean Termite Colony: Apply insecticide to infested wood and void spaces with a crack and crevice injector.

**"The applicator is responsible for effects of insecticide use.
Please read, understand and follow all insecticide label directions.
The information provided in this publication does not supersede
the insecticide label specifications. In case of a pesticide
emergency, you may call CHEMTREC (Pesticide Emergency Network)
Phone: (800) 424-9300."**

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