Control of Termites

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Fig. 1.—Termites working in decaying wood.

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This Bulletin at A Glance

(1) Termites are definitely on the increase in Missouri and are doing much damage to posts and the woodwork of homes and other buildings.

(2) Remember that termites found in Missouri nest in the ground, not up in the woodwork of the building, and all that is necessary therefore is to prevent them from sending the workers up into the house to feed on the woodwork.

(3) In building a new home make sure that all easy points of termite entrance are eliminated, or else install metal termite shields.

(4) If your home has been built for some years, check it for construction faults and possible termite infestation even though you have seen no evidence of termite work. Correct any construction faults which may provide possible later entrance for the termites.

(5) If termite infestation is found, do not expect them to destroy your home in the next few days or weeks, but take steps at once to get rid of them, as pointed out in this report.

(6) If the infestation of the building is so serious that local or spot treatment does not seem practical, call in a responsible termite control specialist to handle the problem.
Control of Termites

LEONARD HASEMAN

In recent years, no other insect pest in this country has received the attention and the publicity accorded the termite. Newspapers, magazines, commercial leaflets, and state and federal publications have devoted thousands of pages to termites and the best means of preventing damage by them. So great has been the interest in this pest that numerous firms and individuals have developed local and nationwide termite control services with branches in most of the larger cities. Termites constitute a definite threat to buildings and other wooden structures. And yet, if a few essential precautions are taken in the construction of new buildings or the necessary changes are made to correct faulty construction in old buildings, danger of termite injury to such buildings can be largely eliminated.

Termites Live in Organized Colonies

Termites are an ancient race of insects, having peopled the earth for millions of years before man appeared on the scene. And yet they enjoy the more modern, highly specialized social or colony life, similar to that of ants and the honeybee. The so-called social insects of these types live in colonies with true male and female reproductives, known as queens and kings or drones, and castes of workers and soldiers and, in some cases, secondary reproductives.

The species of termite so important in Missouri is an underground one which normally has its central nest, home, or termitary below the frost line in the earth. Their nests are never established up in the woodwork of a building. A strong colony may include thousands of workers and soldiers, one pair of fully sexed reproductives, the queen and king, and, frequently, one or several pairs of secondary reproductives which may take over in the absence of the royal couple.

All the individuals comprising the colony are the offspring of the royal couple, and the size of the colony is determined largely by its age and by the reproductive capacity of the queen. It is not definitely known how long the queen and king actually live, but it is believed that they may live for several years and the colony usually increases in size from year to year.

The food of termites is primarily cellulose. The wood of dead trees, posts, buildings, and of other wooden structures supplies termites with most of their food. They are able to utilize wood pulp or other types of cellulose as food, due to the presence in the worker's digestive tract of microscopic protozoans which break
down the cellulose and make it digestible. Along with cellulose they secure needed growth hormones possibly from the wood, or from fungi or molds. The workers digest the wood pulp and regurgitate it as food for the royal couple and other members of the colony.

The workers, by feeding in posts, timbers of buildings, bridges, and similar structures, are the destructive members of the termite colony. Any untreated wood which touches the ground is subject to possible attack, and even timbers of buildings well above ground may be reached and attacked through covered runways or tubes built by the termites from the ground up over the foundations until they reach the woodwork. They avoid the light and do not come out of their tunnels nor travel in the open, as do ants. They seem to have a "wood sense" and no wood is absolutely safe from possible attack, unless it is chemically treated or properly protected by means of some type of chemical or physical barrier.

A home is not likely to be attacked by termites, however, if it does not have wooden steps, basement door or window frames, porch lattices, or other woodwork touching or coming close to the ground, and if it has a fully excavated basement with solid foundations and no woodwork in the basement extending through the concrete floor or resting on floor cracks. They usually can find other more readily available sources of cellulose on which to feed. There are few square rods of land in Missouri, including even pastures,
Fig. 3.—Section of a bearing apple limb showing heartwood consumed by termites.

Fig. 4.—Termite damage to box of envelopes.

meadows, flooded valleys, and dry hilltops, which are not in reach of worker termites from one or more colonies nesting nearby. Any
piece of rail, post, board, or other wood that has been lying on the ground for a time anywhere is likely to have termites working in it. They are found everywhere, so one must treat or otherwise protect posts and wooden structures in order to prevent the possibility of termites reaching and attacking them sooner or later.

![Fig. 5.—Typical covered runways or tunnels made by termites.](image)

**Life Stages and Development of Termites**

As pointed out, termites live in colonies consisting of the reproductive and worker and soldier castes, together with eggs and nymphs in all stages of development. Unlike ants and bees, the termite worker and soldier castes include both males and females which, however, are not fully sexed, due presumably to the food given them when they were young. The nurses feed to those young which are destined to become queens and kings one type of ration or regurgitated food, and to those which develop into soldiers and workers other types of food. Just how the food works in making a soldier, with large head and jaws, out of one individual and the trim workers out of others is not easy to understand, but it seems to do so nevertheless.

**Eggs.**—The termite eggs are very small and are produced by the queen at the rate of several thousand a day during the heavy
breeding period. The workers which attend the queen take care of the eggs and store them in special compartments in the nest where they incubate for several days before hatching.

Nymphs.—On hatching, the small whitish-colored nymphs are quite active and crawl about in the nest among the older nymphs and the workers. In this stage, they are fed predigested food by the regular nurses since they are unable at first to digest wood pulp or other forms of cellulose. As they grow larger they shed their skins as do other young insects and, in due time, they begin to assume the form of wingless workers, soldiers, or winged queens and kings. As the young workers develop they receive a supply of the cellulose-digesting protozoans along with the regurgitated food given to them by the nurses. As a result, they, in time, are also able to digest cellulose and to supply regurgitated food to other members of the colony.

Workers.—Except at swarming time, a termite colony consists largely of the small, active, wingless, yellowish-white workers. These are commonly called "white ants" or "wood ants". Turn over an infested piece of wood and what you see mostly are the workers with an occasional large-headed soldier. The workers are about a quarter of an inch long and, unlike true ants, they have thorax and abdomen broadly joined at the waist line. The dark food in the digestive tract usually shows through the body wall. These active workers perform most all of the labor of the colony. Besides gathering and digesting the food, they nurse and feed queen and king and the young, they care for the central nest, they build earthen tubes or covered runways in search of new food supplies, and in case of danger they help the soldiers to guard the nest and its inhabitants.

Soldiers.—The termite soldiers guard the colony against the attack of enemies, especially the true ants. If an infested piece of wood is turned over, thus breaking open the feeding and communication tunnels of the termites, the soldiers promptly plug up the ends of the tunnels with their heads and snipping, scissor-like jaws until the workers can mend the breaks or retreat back to safety. In such cases, the true ants are always ready to attack the exposed soft-bodied termites, but the animated scissors of the soldiers are used with telling results on any unlucky ant that walks into them. Some students of termites claim that the active workers are about as good fighters as the soldiers, but they are certainly no match for the true ants which prey on them.

The soldier termites are slightly longer than the workers, more slender, and with a more athletic build. They are more deliberate in their movements and usually keep their large jaws snapping as though they expected some enemy to walk into them at any moment.
The outstanding thing about them is the large, hard, chitinized head and jaws.

**Queens and Kings.**—The fully sexed forms, both males and females, have four long, slender, heavily-veined wings. On casting their skins the last time to become adults, the wings expand to full size. Hundreds of these reproducitives mature just prior to the emergence of a swarm. Unlike the workers, the bodies of these are black and more heavily chitinized. They are somewhat larger than the workers, and the four long wings extending well beyond the tip of the abdomen greatly exaggerate their actual size.

![Image of termite forms](image)

**Fig. 6.**—
(a) Winged sex form as it appears at swarming time.
(b) Immature sex form without fully developed wings.
(c) Worker.
(d) Soldier.

Colonies of termites usually swarm during the spring, though some swarm in the fall. These swarms often include thousands of the young winged reproducitives. They may issue from subterranean tunnels alongside foundation walls, a stump or post, or they may swarm indoors from an escape hole in the floor, door frame, or in the basement where the colony is attacking the wood-
work in a house. Their wings are weak and they usually do not fly far from the place where the swarm emerges. On alighting, they break off their long wings close to the body along a weak link provided for that purpose and then set about establishing a new colony. They go in pairs, a male and a female. Fortunately, however, very few of them ever succeed in establishing new colonies.

The queen or mother of a strong colony, at the height of egg-laying, may be an inch or more in length; in fact, the queens of some tropical species may be two or more inches long, the abdomen being stuffed to bursting with thousands of eggs. Such a queen is helpless and must be fed and cared for by workers. She and the king live in the royal suite and as the eggs are laid the nurses collect and store them in other compartments of the nest where they incubate.

Preventing Termite Damage

In Missouri, damage by termites has been definitely on the increase in recent years. Originally, termites were tropical insects, but the underground species which is so important in this state has been moving north and adapting itself to colder climate. It nests below the frost line, sometimes alongside warm basement walls where the colony may remain active throughout most of the year. In the open country during the winter months termites are relatively inactive, but they seem able to survive the cold even as far north as the Canadian border.

As mentioned before, almost any piece of wood or other object containing cellulose, which is accessible to termites, may be attacked. Fence posts, telephone, telegraph, and electric line poles, stakes, books, papers and, above all, the woodwork of buildings, are most in need of protection from termites.

In controlling or preventing termite injury, it is not practical to hunt out and destroy the subterranean colonies by any present known method. We are, therefore, forced to depend on the protection of the structures from attack. To do this, we may either treat the wood or other material or structure with some chemical which will kill or repel the worker termites when they attack it, or we may resort to the use of a chemical or a physical barrier that prevents the termites from easily reaching the object or wooden structure being protected.

Protecting Posts.—Any wood that is set in the ground, such as fence posts, telephone, telegraph and electric line poles, stakes, bean poles, and the like, can best be protected by impregnating at least the part that goes into the ground with some chemical such as creosote, which tends to preserve the wood and also protects it from attack by termites. Most telephone and other line poles are now completely impregnated with chemicals by using heat and pressure.
On the farm, fence posts can be treated by standing them on end in a barrel or in an old oil drum containing the creosote. When possible, fence posts of the more durable types of wood, such as white oak, red cedar, osage orange, and locust should be used. Where the posts are not impregnated it will help to protect them from termites and to prolong their life if one will combine some creosote or lead arsenate, calcium arsenate, or other repelling or killing chemical with the dirt as it is being tamped about the post. The setting of wooden posts in concrete is not satisfactory as a protection from termites.

Proper Construction to Protect Buildings.—The proper construction of a building to prevent termites from easily reaching the woodwork is the cheapest insurance against injury later. Likewise, old buildings showing faulty construction along these lines should have such faults corrected, preferably before termites begin to attack them, and, at least, before serious damage has been done. Frequent repairing and replacement of termite-damaged timbers in a building is expensive and fails to give lasting relief. All skilled architects today take termites into account when they make plans and specifications for a home or other building containing woodwork.

Prevent Wood From Touching the Ground.—Such plans should, first of all, prevent any permanent woodwork from coming in contact with the ground. This includes wooden porch or basement steps, porch lattice, trellises, basement window and door frames,
basement supporting posts, coal bin, fruit and vegetable shelves, and the like. If any such woodwork touches the ground or rests on faulty, cracked basement concrete floors, it will simply invite termites and provide them with access to other timbers of the building. The same things are true whether the building is a residence, store, mill, bank, or chemical laboratory. Such faults in building construction must be eliminated if termites are to be controlled.

Avoid Earth-filled Concrete Porches.—Another danger spot is where a dirt-filled concrete porch joins the house on a level with the first floor joists. This is true even when brick and tile or concrete are used in the side walls. Termites have a way of working through the masonry of such walls from the dirt fill beneath the concrete porch floor, thus coming directly in contact with the first floor joists. Such porches should be set down one step below the first floor joists or, better still, they should be excavated the same as the rest of the basement and provided with light and ventilation.

Fully Excavated Basement Preferable.—Still another source of danger is where a part of the basement is not excavated, or, worse still, where there is no basement at all and where the foundation wall raises the floor only a few inches above the level of the ground. In such cases, too often the termites select a dark corner and build their tunnels from the ground line up over the inner and occasionally outer surface of the foundation wall and thus reach the heavy first floor timbers.

Termites may even extend their subterranean tunnels down 4 to 6 feet in the ground so as to pass under the footings of foundation walls if the house has a fully excavated basement and then come up through a crack in the concrete floor and build their earthen tunnels back up on the inner face of the wall 6 or 7 feet until they reach the sills or joists above. Where the house has no basement at all, or where a part of it is not fully excavated, one should either treat the soil along the inner face of the foundation or impregnate the exposed timbers or else depend on metal termite shields for protection, as discussed later.

Use Concrete Footings Under All Basement Timbers.—Termites readily excavate tunnels 4 to 6 feet deep in the ground, thereby working down under the concrete basement floors. As insurance against later attack from termites, it is important that the basement, concrete floors be free of cracks and preferably that all supporting timbers in the basement be raised six inches above the level of the floor on concrete piers. The central heavy supporting posts, in particular, should have concrete piers six to eight inches high under them. Partition walls of fruit cellars or coal bins should also preferably be raised above the basement floor on concrete footings or else tile, brick, or concrete should be used in such walls.
Keep Foundations and Basement Floor Free of Cracks.—For permanent protection against termites, reinforced concrete of proper mix should be used in the foundation walls, at least up to a point above the ground level. If stone, brick, or tile is used below the ground line, rich cement mortar should be used in the joints and even then termites may break through. Even where reinforced concrete is used in the foundations walls, settling cracks may appear, especially in years of unusual droughts, and when this occurs these cracks should be resealed all the way through the wall or termites may begin below the ground level and build their tunnels along these cracks and thus reach the woodwork above. Also, cracks in the basement floors and where the concrete floor joins the foundation walls should be sealed, or later termites may break through to damage the house or things stored in the basement.

Use Areaway for Low Basement Windows.—Frequently, new as well as old houses have some of the basement windows so close to the ground line that the soil piles up on the window frame. When this occurs termites are almost sure to work up through the window frames and into the sills and heavy timbers above. When this occurs, an areaway made of rich concrete should be built in front of the window to prevent the dirt from coming in contact with the window sill. Some overcome this difficulty with metal basement window frames and sashes.
Chemical Impregnation of Under-Timbers.—When for any reason the above preventive measures have failed, or additional protection to homes and other buildings is desired, one may resort to the use of chemicals for impregnating the heavy first floor timbers and other exposed woodwork. Some of the larger termite control organizations have special chemicals and depend largely on this method of treating for termites. Theoretically, if the chemical would make the wood permanently termite-proof, this control practice should be next to perfection itself. Actually, however, its effectiveness depends upon the length of time the chemical will fully protect the wood against termite attack.

Being a rather expensive treatment the chemical should protect the wood for a longer period than five years, the usual length of the guarantee given by some commercial firms. There is no question that the principle on which this treatment is built is sound, but for permanency and economy the chemical should preferably give lifetime protection to the wood. Experience seems to indicate that the chemicals now in use do not do this. Also, where wood impregnation alone is used the pest can construct its tunnels up over the impregnated timbers and thereby reach the untreated timbers above.

To properly impregnate timbers in buildings, a small bit may be used to bore holes almost through the ends of joists from bottom to top and in basement window frames, sills, studs, and other exposed under timbers. Then the chemical may be forced in under pressure and allowed to penetrate with the grain of the wood so as to reach substantially all of the exposed part of the timber treated. Usually only those timbers or ends of timbers must exposed to attack, such as basement window frames, sills, and the ends of the studs and joists resting on the sills or foundation walls are treated.

Kerosene and creosote may be used to simply paint onto the exposed parts of timbers as temporary repellents. Orthodichlorobenzene or penetrating light petroleum oil impregnated with a poison or repellent, such as chlorinated phenols or beta naphthol, that will crystallize out and remain in the grain of the wood after the volatile chemical is gone may be used for deep impregnation of timbers. There are on the market a number of patented wood preservatives and some of these have proven quite satisfactory for protecting timbers of buildings from termite attack.

Poisons such as arsenicals, sodium fluoride, zinc chloride, mercuric chloride, copper sulfate, and others, in various combinations both in water and in light petroleum oils, have also been used with varying degrees of success for protecting timbers of buildings, as well as for soil treatment where the timbers touch the ground.

For more effective control of termites, however, we are in need of a safe, cheap, readily available chemical or combination of
chemicals for permanently proofing timbers against later attack by termites.

**Chemical Treatment of Soil.**—Where faulty construction cannot be corrected easily and where impregnation of exposed wood is not feasible or desirable, one can prevent termites from working up into the woodwork of houses or other wooden structures by using a chemical to impregnate the soil along foundation walls and around supporting piers. To be effective the chemical should repel or kill the termites as they attempt to work up through the soil and over the foundations and into the woodwork. Creosote used at the rate of one gallon to each ten linear feet of foundation will usually repel termites for a season.

If used along the inside of the foundation wall, where there is no basement or where part of the basement is not fully excavated, it will last longer. To apply it, make a V-shaped ditch six inches deep against the foundation, pour the required amount evenly along in the ditch and refill the ditch with the dirt. Other chemicals used with varying degrees of success to treat soil include orthodichlorobenzene, kerosene, crude oil, discarded crank-case oil, arsenicals, fluorines, mercuric chloride, copper sulfate, zinc chloride, and others. The effectiveness of such treatments depends upon the lasting qualities of the chemical used.

**Metal Termite Shields.**—Metal termite shields consist of some durable noncorrosive metal fitted over the foundation wall all the way around on which the sills, joists, and other woodwork of the house rest. It serves as a permanent metal guard between the termite nests in the ground and the woodwork of the house. To work properly the shields should be fitted so that they extend horizontally about 2 inches beyond the foundation wall both on the inside and on the outside, and beyond this point they should turn downward two more inches at an angle of 45 degrees. In other words, for an 8-inch wall the shields should be about 16 inches wide and should have the two inches along either edge bent downward at a 45-degree angle. These same types of shields should be fitted in or around chimneys, porches, soil pipes, gas and water pipes, and over supporting pillars or footings in the basement or under the center of the house if there is no basement.

The main foundation shields are cut and fitted around the corners and soldered together into a continuous guard or shield. If these shields are properly fitted with the edges turned downward, termites will not pass them, as the Missouri Agricultural Experiment Station has determined from repeated experiments. Improperly fitted they may prove worthless. If installed as the house is built they will cost from $50 to $100 for an average sized house. If the house must be jacked up and the shields fitted in between the foundations and the woodwork
the cost is greater and the results usually not so satisfactory. However, this is one way in which a building can be protected from future attack by termites so long as the shields last and are kept in proper shape.

Properly installed, metal shields serve as a perfect mechanical barrier due to the fact that the termite workers do not seem to know how to reverse the direction of their tunnels when they reach the turned down edge of the shield. As a result, they go right ahead and extend the tunnel back to the ground or basement floor.

Preventive Measures in New Construction

In building a new home, make sure that it does not include any of the faults in construction herein pointed out, which serve to invite termite trouble. Let no woodwork touch the ground anywhere. Protect low basement windows or use metal frames and sashes. Reinforce concrete basement floors and foundation walls to prevent cracks later. Use concrete footings under all basement woodwork. Avoid earth-filled concrete porches. As added permanent protection, preferably install metal shields.

Consult a Termite Specialist

In case of a home or other building which is known to be infested, or which is likely to become infested with termites, carefully go over it or hire a termite specialist to check for construction faults and find out where and how the termites are making contact with the woodwork or where they may later find it easy to reach the woodwork. If such faults are present and termites have not yet found them, correct or repair them at once. If termites have located such faults and are already working up into the woodwork of the house, block them out with chemicals, as previously pointed out, until the faults in construction can be corrected with permanent barriers over which the termites are not likely to pass. This may include nothing more than the making of a few badly needed repairs, again it may call for the installing of metal shields, or it may require the service of an experienced termite specialist in giving a complete termite-proofing to the building.

There are several termite specialists in the state and they should be employed whenever spot treatment and correction of faulty construction are not adequate. In most cases, however, spot treatment with proper repairs to correct construction faults will serve to turn the pest to other available sources of food. It is always better to discover and eliminate all easy points of entrance before the termites find and use them, for once they get a taste of the woodwork, it is more difficult to turn them back and prevent them from again reaching the woodwork at some other point.