



# Subterranean Termite Biology and Behavior

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## Introduction

Subterranean termites are the single greatest economic pest in the United States. These termites cause billions of dollars in damage each year to homes, historical structures, and commercial buildings. In addition to buildings, termites also consume valuable books, documents and photographs. Subterranean termites have existed for over 55 million years and are extremely good at what they do. A great deal of their success can be attributed to their cooperative behavior. Subterranean termites are social insects. This means that they live in family groups called colonies. Social insects are different from other insects (grasshoppers, cockroaches, or beetles) because each termite in the colony performs a specific job that benefits the colony as a whole. Most other insects work only for themselves. For example, each individual grasshopper will feed and reproduce itself independently of its siblings. In the termite colony an entire group or caste of termites is responsible for feeding their parents and siblings, while another caste is responsible for reproduction. Because of this division of labor, the colony of individuals functions as a single animal. The following is a description of how a subterranean termite colony becomes established and how the different castes interact and communicate as the colony grows.

## Colony Establishment

During the daylight hours of the spring months (March-May in Virginia) homeowners may begin to see winged termites emerge in large numbers inside their home or from the soil outside. These are the subterranean termite swarmers. The swarmers are new termite kings and queens that must leave their parent colony in order to mate and establish new colonies of their own.



Swarmer with workers

The termite swarmers pair up during their flight then land and search for a place to begin a family. Their wings break off shortly after landing and the new king and queen start their colony by excavating a small chamber in a crevice or plot of soft soil. When the chamber is large enough, they crawl inside, seal the opening and mate. From this point on, they will spend the rest of their lives underground. The queen lays her first batch of (6-12) eggs within a few days or weeks of mating. Initially, the king and queen tend the young termites. However, as the queen's egg laying capacity increases, the older offspring begin to tend their younger siblings. The colony will now continue to grow with increasing numbers of termites being produced each year. The parental king and queen have the longest life span in the colony. They often survive for a decade or longer and can produce huge colonies with thousands of offspring.

The subterranean termite most commonly found in Virginia is the Eastern Subterranean termite, *Reticulitermes flavipes*. Mature colonies (6-7 years old) of *R. flavipes* in Virginia have been estimated to contain more than 60,000 workers. These large subterranean termite colonies often become decentralized over time and occupy multiple nesting sites interconnected by a network of underground tunnels.

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## Subterranean Termite Castes

### Primary Reproductives

As described above, mature subterranean colonies, at certain times of the year, will produce large numbers of winged swarmer or “alates” that will eventually become king and queen termites. These royal termites are dark-colored and are the only caste with functional eyes. The swarmers lose their wings after a short flight where they select a mate. The new king termite remains virtually unchanged after losing his wings. However, as the new queen begins to produce eggs her abdomen grows larger with the development of her ovaries. As she stretches, the segments of her body pull farther apart showing the white membranes between the segments of her abdomen. This gives the queen a striped appearance. The eastern subterranean termite queen will stretch until she is about 14.5 mm in length. At this point she is an egg laying machine, producing over 500 offspring a year.



Queen

### Secondary Reproductives

The termite colony originates from a single pair of reproductive swarmer termites, the king and queen. However, if the king or queen should die, other individuals within the colony will start to develop functional reproductive organs to take their place. These individuals are called secondary reproductives. Secondary reproductives are light in color but they are larger than workers and never develop wings. In mature colonies a secondary reproductive caste can develop even though there is still a producing queen present. When this happens the secondary reproductive caste members will produce the majority of the eggs, causing the colony to grow at a much faster rate. Although no individual secondary reproductive can produce as many eggs as the queen, several hundred of them may exist in a single colony thus producing thousands of eggs. Secondary reproductives may also develop in satellite nests where a group of workers

have become separated from the parent colony. This splitting or budding of the nest expands the original colony’s foraging territory.

### Worker Caste

Subterranean termite workers are the caste found in infested wood. As in other termites species, the workers are responsible for all of the labor in the colony. They care for the young, repair the nest, build foraging tunnels, locate food, feed and groom the other castes and each other. The youngest termite workers perform the tasks inside the colony like feeding, grooming and caring for the young, while the older more expendable workers take on the hazardous jobs of foraging and nest building. The termite workers are both male and female but they are functionally sterile. They are milky white in color and have no wings or eyes. The body of the termite worker is soft, but its mouthparts are very hard and adapted for chewing wood.



Worker

### Soldier Caste

Subterranean termite soldiers are the defenders of the colony. They protect the colony against marauding ants and foreign termites. When foraging tubes or gal-



Soldier



Utility tubes

eries are broken into the soldiers congregate around the break to stand guard against invaders. Soldiers are similar to the termite workers in that they are blind, soft-bodied and wingless. However, the soldiers have an enlarged, hard, yellowish-brown head which has been modified for defense. The head has a pair of very large mandibles or jaws that are made to puncture, slice and kill enemies (primarily ants). However, the large mandibles prevent the soldiers from feeding themselves, so they must rely on the workers for food.

## Subterranean Termite Behavior

It is not known exactly how subterranean termites locate sources of food. It is thought that the termites forage by digging a network of tunnels and come in contact with food sources in the process. The foraging range of a single termite colony is difficult to predict. Some larger colonies may forage over areas the size of a football field. However, depending on the season or weather, they may not forage over their entire range at all times. Also, several smaller colonies may cover a greater foraging distance than one large colony.



Swarm tubes

Foraging termites produce a variety of chemicals called **pheromones** that influence their behavior. These pheromones are basically odors that send messages to other termites in the colony. While tunneling underground, the foraging termites lay down a trail of pheromone which they secrete from glands on their abdomen. When a food source is located, the odor trail is intensified to recruit other termites to the feeding site. However, the intensity of the recruitment effort (odor trail) is influenced by soil temperature, moisture and compaction as well as the size and quality of the food source.

Subterranean termites also forage above ground for sources of cellulosic food like wood in homes and other structures. In order to protect themselves from predation by ants and maintain their connection to the soil while searching for food above ground, termites build long tubes out of mud and fecal material. These mud tubes are called **exploratory tubes**. Termite exploratory tubes are very easy to see and are one of the best ways to identify a potential termite infestation. Once a source of wood has been located, the termites establish more permanent **utility or working tubes**. The utility tubes are highways running from the underground termite galleries directly to the food source. Utility tubes can cover long distances over the foundation of a building or along exterior walls to reach the wood inside. Sometimes subterranean termites build another tube that runs from the structural wood back down to the ground. These tubes are called **drop or suspended tubes**. Drop tubes are often lighter in color than the utility tubes because they contain more of the wood fiber taken from the structure. Subterranean termites construct a fourth type of mud tube in addition to those that facilitate foraging. These are called **swarming tubes**. Swarming tubes are built seasonally extending only 4-8 inches above ground. These tubes provide the exit port for winged swarmer leaving the colony.

## Moisture Needs

Subterranean termites are constantly at risk of drying out; this is why they must live in the soil. Soil has the capacity to hold water for a long period of time and keep the colony moist. When termites forage above ground, they must maintain their connection to the soil so that the workers and soldiers can return periodically to replenish their body moisture. The mud tubes provide the termites with this soil connection. If a tube becomes damaged, the worker termites will labor desperately to repair it. If the tube is beyond repair, the termites located above ground will often die of dehydration. However, on some occasions subterranean termite colonies do become established above ground. These above ground infestations are almost exclusive-

ly found in structures with chronic moisture problems. Chronic problems include flat roofs where dead leaves and moisture have been allowed to accumulate, leaking pipes or areas with no ventilation. In such cases the colony can survive above ground indefinitely.

## Nutrition and Feeding

Although subterranean termites can chew through and damage many materials, they can only obtain nutrition from cellulose. However, subterranean termites cannot digest cellulose on their own. In order to digest wood, subterranean termites have large numbers of microorganisms in their gut that convert the wood fiber into usable nutrients. If there were no microorganisms in the gut, the termite could eat constantly but still die of starvation. In the colony most food is shared mouth to mouth (a process called **trophallaxis**). Foraging worker termites feed directly on wood or other cellulose material then store the food in their gut. They then return to the nest and feed the immature termites, soldiers, and reproductives.

Immature termites are unique in their nutritional needs because like all juvenile insects they must periodically shed their skin (exoskeleton) in order to grow (molting). When they do this they also shed the lining of their hindgut where the wood-digesting microorganisms live. After molting the termites no longer have their microorganisms and are unable to digest food. In order to replenish their microorganism supply, the young termites feed on fluids (which contain the microorganisms) excreted from the hindgut of older

termites. This delicious practice of feeding from a nest mate's anus is called **proctodeal feeding**. Although it may sound disgusting, proctodeal feeding is essential for the survival of the termite colony.

## Swarming Behavior

Swarming is the termite method of dispersal and establishing new colonies. Subterranean swarmer emerge from the colonies at certain times of the year when conditions are suitable. Peak swarming season for the subterranean termites in Virginia is from March through June. The eastern subterranean termite, *R. flavipes*, usually swarms in the spring (March-May) during the daylight hours on warm days following a rain. Subterranean termite swarmer are attracted to light so if they emerge indoors they will be seen flying to windowsills and open doors. Usually, termite swarming either indoors or outside is the first indication to homeowners that they have a subterranean termite infestation.

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