Print

LSU AgCenter
innovate, educate, improve lives
www.lsuagcenter.com

more... > *Formosan Subterranean Termites* > *Native vs. Formosan* >

Comparison of Native and Formosan Subterranean Termites Biology, Ecology and Methods of Control

Worldwide, subterranean termites in the family Rhinotermitidae are composed of about 140 species distributed among 12 genera. Of the 4 genera of Rhinotermitidae in the USA, Reticulitermes and Coptotermes are the most economically important. *Coptotermes formosanus* Shiraki invaded the continental U.S. in the 1950s and has become the most destructive termite species in a growing number of southern states. This article compares and contrasts the Formosan subterranean termite, *C. formosanus*, biology, ecology and foraging behavior with *Reticulitermes* spp. and evaluates the different termite control strategies used against them.

Subterranean termites are susceptible to many abiotic and biotic stresses including the climate, fungi, bacteria, predatory insects and vertebrates and the desiccating conditions of hot and dry weather. A single worker termite soft-bodied and extremely fragile, yet a colony of termites may survive for decades and cause thousands of dollars in damage and repair costs to a home. The biological "trick" to the achievements of termites is the social structure present in all of the Isoptera.

Termites are social insects, the earliest animal society known. Being 200 million-plus years old, their geologic age attests to their degree of success. A colony of termites engage in specific tasks that maintain homeostasis and optimize efforts to collect and consume wood efficiently. The Rhinotermitidae is most generally identified by the structure of the fontanelle on the head of a termite soldier. The fontanelle serves as the opening to the frontal gland and gives the soldier termite a somewhat rhinoceros-like appearance in miniature form. Formosan subterranean termite soldiers have been called "milk termites" because of the copious amounts of frontal gland defensive secretion that contributes to almost half its total wet body weight. Nearly one-fourth of the total colony population may be represented by the soldier caste in this species. Thus, this gland has a larger volume than all other termite glands put together. In contrast to C. formosanus, about 2% of a Reticulitermes colony is made up of soldiers, and their gland, though present, is equipped with a smaller fontanelle and a miniscule amount of fluid. The chemical and physical defense of the colony is one role of the soldier. The soldier termite represents the only sterile caste in the subterranean termite society. Their numbers in a colony can influence the development of reproductives and further suppress soldier production. Helping brother and sister termite workers to become reproductives increases the soldiers' inclusive fitness. Primer pheromones and active defense of the colony accomplish this task.

Colonies of subterranean termites are very slow growing, composed only of about 30 individuals one year after the king and queen have paired. Production of alates (winged reproductives) requires many years of colony growth and a superfluous amount of cellulosic-food. After about seven years, a healthy colony of subterranean termites produces alates that swarm from the colony. Each species has a particular time of the year that they swarm and in colder climates swarms take place later in the year compared to warmer climates. All subterranean termite alates are positively phototactic during and immediately after flight. Native subterranean termites fly during the day and their attraction to light is not obvious. Formosan subterranean termite alates fly after sunset and collect at bright lights (or reflections of light) as night falls. Within hours of swarming, males and females pair off, drop their wings and attempt to locate a nest. *Reticulitermes* and *Coptotermes* are repelled by light after the wings are shed and male/female bonds are formed.

Generally speaking, the life cycle of a subterranean termite is similar among the species in the family Rhinotermitidae. Besides colony formation through primary reproductives, all of the rhinotermitids are reported to be capable of producing brachypterous and/or neotenic reproductives. However, only *Reticulitermes* spp. frequently generate secondary reproductives in the laboratory. The production of secondaries can allow for colony dispersal in the field through splitting or budding from the mother colony. Dispersal through budding probably helps Reticulitermes to be transported worldwide in infested commercial goods. Field populations of *R. flavipes* (Kollar) in the northern U.S. most commonly (or exclusively) start new colonies through secondary reproductives and the production of alates is rare.

In contrast, *Coptotermes formosanus* does not produce secondary reproductives in the laboratory, though field excavations of nests have uncovered multiple secondary queens and kings. Primary reproductives swarm in late April through July in Louisiana. Large swarms that can disrupt evening activities for residents and guests of the French Quarter in New Orleans suggest that *C. formosanus* use primary reproductives predominantly in colony initiation. Commercial transport of infested materials is facilitated by this species' above-ground nesting habits (see below).

Reticulitermes spp. are found throughout the world in temperate regions. Our most cold-tolerant species, *R. flavipes*, is as far north as Winnipeg, Canada, in North America. *C. formosanus* is a semi-tropical species. Having originated from southern China, it has slowly been spread through infested ships and goods into port cities. Its northern limit is North Carolina, though it has been suggested that spread to Washington State along the west coast and Boston along the east coast is probable. Both genera require cellulose-based food. The most important ecological limitation for Rhinotermitidae survival is water.

In Lake Charles, La., Formosan subterranean termites infest living tupelo gum and bald cypress trees that are water-bound. As such, these trees serve as reservoirs for spreading alates from mature, tree-bound colonies along the river ways and bayous. The habit of building carton nests within trees and above the waterline helps these termites avoid drowning during high water. Similar above-ground nest structures are not built by native subterranean termites. Native subterranean termites are not found infesting these water-bound trees.

Another feature of *Coptotermes* that may benefit its dispersal along waterways is the hairy wings of the alates. *C. formosanus* has an abundance of wing hairs that may help them float longer than could the hairless wings of *Reticulitermes*. Alates able to float longer may be able to drift into a riverbank or climb onto a floating log.

Subterranean termites have another adaptation against water inundation. In laboratory experiments, workers of both Reticulitermes and C. formosanus were shown to go into a quiescent state when submerged under water. They can be completely submerged underwater more than 11 hours before death occurs.

Trees in forested areas and urban parks and neighborhoods also become infested with subterranean termites. In Louisiana, Formosan subterranean termites infest a higher percentage of living trees than do native subterranean termites where both coexist. For example, in a state park near Lake Charles, La., 6% of the living trees were found to be infested with C. formosanus, whereas 0.5% were infested by *Reticulitermes* spp. Moreover, rarely do native subterranean termites consume enough xylem that they cause a structural weakness in the tree as Formosan subterranean termites often do.

Urban trees censured in New Orleans and Lake Charles, La., also show higher rates of infestation by Formosan subterranean termites, and maples, pecans and red oaks are preferred over many faster growing "softwood" trees. Tree preference may be influenced by many factors including nutritional components of the wood, amount of sapwood versus heartwood, differences in spring and summer growth rings, fungal decay, moisture, wood hardness and natural repellents. For native subterranean termites, wood consumption is negatively correlated with wood hardness. For Formosan subterranean termites, wood consumption is correlated more so with nutritional components of the wood. Laboratory studies indicate that Formosan subterranean termites are healthier and produce more offspring when fed wood types they prefer. Since red oak is one of the preferred woods it is no wonder that Formosan subterranean termites commonly infest used railroad ties made of red oak. Used ties are sold as landscaping timbers and are a common means of interstate transport of colonies.

One of the more recent advances in termite control is the development of bait systems. Several baits now on the market can reduce the population of termites if enough of a slow-acting toxicant is consumed. Subterranean termites generally find baits placed in the ground while they are searching for additional food sources. The search and foraging behavior of subterranean termites is influenced by pre-existing tunnels, wood species, food size, colony size and volatiles associated with wood and fungal extracts. Subterranean termites show a strong fidelity for discovered high-quality food sources. Formosan subterranean termites are more likely to consume a larger amount of food at a favored site before moving on to a new site when compared with *Reticulitermes* feeding. This could be an advantage for baiting of Formosan subterranean termites if baits are placed in locations where the termites will quickly find them.

Additives in the form of attractants, feeding stimulants and trail following substances are being investigated as a way to increase bait efficacy. One recent discovery is the chemical 2-phenoxyethanol that is a common additive to ballpoint pen inks. This chemical causes trail following in both *Coptotermes* and *Reticulitermes* and is being examined as an additive to baits. Proper bait placement and regular inspection is key to any potential success using baits.

Foraging by *Reticulitermes* and *Coptotermes* is non-random. This means that a predictable foraging strategy could be quantified if enough information were available. However, subterranean termites are cryptic insects and the underground profile of food debris and soil features are often hidden from our view. Formosan subterranean termites build larger and fewer galleries underground compared with native subterranean termites even when food sources and locations are similar. Their colony size can be 10X the size of a native subterranean termite colony. This is the single most important factor that makes Formosan subterranean termites so difficult to control and substantially increases the repair costs. These differences need to be considered when using baits or liquid termiticides.

Formosan subterranean termites are more chemical-tolerant to most liquid termiticides and wood treatment products than are native subterranean termites. In part, the foraging tenacity and gallery making behavior of Formosan subterranean termites tend to keep them from coming into contact with soil termiticides as often as might a foraging *Reticulitermes* colony. Again, this fact can be an advantage to controlling them, since direct treatment of termites using a non-repellent termiticide can increase the potential transfer of the toxicant to other termites. Rather than transfer through mutual feeding (trophallaxis) as with baits, non-repellent termitcides are transferred through mutual grooming (allogrooming) and body contacts. Grooming and contacts among rhinotermitid conspecifics occur more frequently than does trophallaxis.

The second important feature in the biology of Formosan subterranean termites that makes them more difficult to control is their construction of above-ground nests. All mature subterranean termite colonies have multiple nest centers, but Formosan subterranean termites use above-ground nesting sites in addition to below-ground nesting sites. They build nests in trees and in homes and buildings. Above-ground carton nests can be very large and the moisture they contain can alleviate the need for the colony members to continously return to the ground for water. Using conventional repellent termiticides against the Formosan subterranean termite can often fail because of this behavior. Sometimes fumigation of a whole building is required for a severe Formosan subterranean termite infestation.

Treating the wood with borates or heavy metals keeps subterranean termites from eating the wood and is the most direct way to reduce costs associated with termite damage. Treated wood products must be consumed by termites to cause any significant mortality. These treatments are not repellent, however, and termites can bypass treated wood and consume untreated cellulose products and structural framing in a home. Wood treatments should not be considered as a means of repelling or keeping subterranean termites out of the home. As such, liquid termiticides and/or baits should be used when attempting to protect your home from subterranean termites.

Posted on: 4/18/2005 9:54:08 AM