

Formosan Subterranean Termite, *Coptotermes formosanus* Shiraki (Insecta: Blattodea: Rhinotermitidae)¹

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Introduction

The genus *Coptotermes* contains the largest number of termite pests (28 species) among the >3,100 termite species worldwide, and the Formosan subterranean termite, *Coptotermes formosanus*, is the most widely distributed and most economically important. The Formosan subterranean termite acquired its name because it was first described in Taiwan in the early 1900s, but *Coptotermes formosanus* is probably endemic to Taiwan and southern China. This destructive species was apparently transported to Japan prior to the 1600s and to Hawaii in the late 1800s (Su and Tamashiro 1987). By the 1950s, it was reported in South Africa. During the 1960s it was found in Texas, Louisiana, and South Carolina. In 1980, a well-established colony was thriving in a condominium in Hallandale, Florida. A single colony of Formosan subterranean termite may contain several million termites (versus several hundred thousand termites for native subterranean termite species) that forage up to 300 ft in soil (Figure 1). Because of its population size and foraging range, the presence of Formosan subterranean termite colonies poses serious threats to nearby structures. Once established, Formosan subterranean termite has never been eradicated from an area.

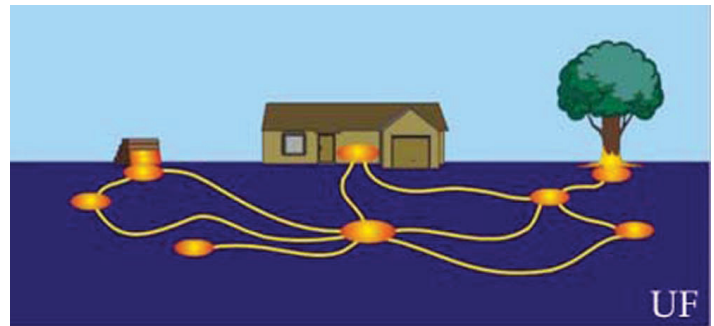


Figure 1. A single colony of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, may contain several million individuals that forage up to 300 ft in soil.

Credits: Nan-Yao Su, UF/IFAS

Distribution

As of 2019, the distribution of Formosan subterranean termite in the United States includes Alabama, Florida, Georgia, Hawaii, Louisiana, Mississippi, North and South Carolina, Tennessee, and Texas (Figure 2).

The Formosan subterranean termite was first reported in Florida in early 1980s in Hallandale, Broward County, but it was probably introduced there at least five to 10 years previously. As of 2019, Formosan subterranean termite is found in almost all major urban areas of Florida (Figure 3). In urban southeastern Florida where the Formosan subterranean termite was first found, its distribution has

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expanded to include much of the costal areas of Dade, Broward, and Palm Beach Counties. Click [this link](#) for the most recent update of Formosan subterranean termite distribution in Florida.



Figure 2. Known distribution (between dotted yellow lines) of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, in the United States, as of 2016.

Credits: Nan-Yao Su, UF/IFAS

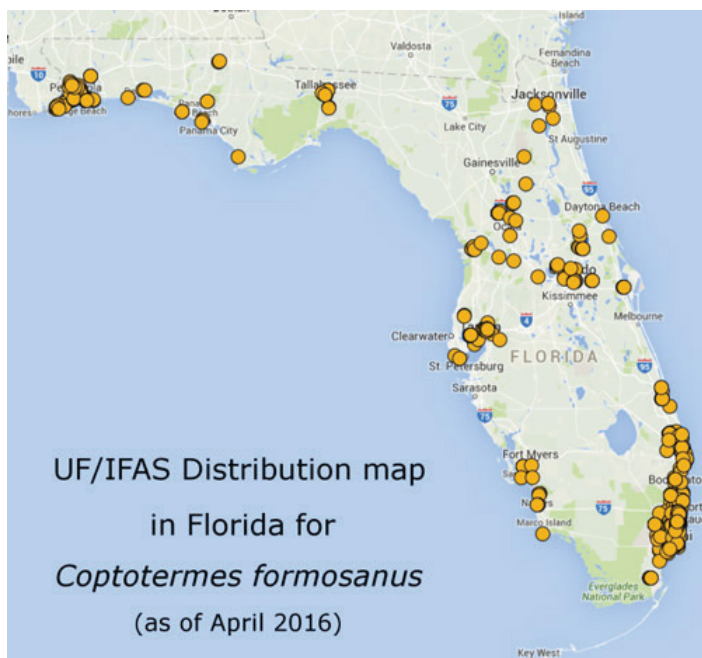


Figure 3. Known distribution of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, in Florida, as of 2019.

Credits: Thomas Chouvenc, UF/IFAS

Description and Identification

As its name indicates, the Formosan subterranean termite is a subterranean termite species characterized by large populations that share interconnected foraging galleries in soil. When these termites invade a house aboveground, foraging tubes of around 0.25 to 0.5 inch diameter may be found connecting soil and the infested house (Figure 4).

As with other termite species, colonies of FST contain three primary castes: the reproductives (e.g., king, queen, alates or swarmers, and immature alates or nymphs), soldiers, and workers. The majority of the nestmates are workers that are responsible for acquisition of nutrients, i.e., cellulose in wood. Alates and soldiers are most useful for identification (Scheffrahn and Su 1994).

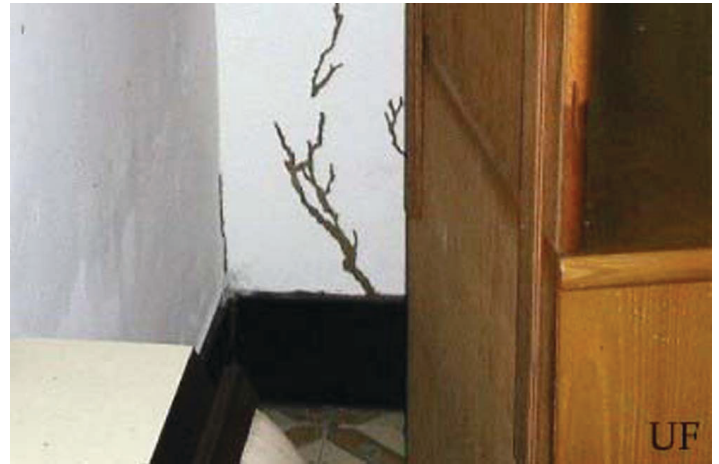


Figure 4. Foraging tubes of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki.

Credits: Nan-Yao Su, UF/IFAS

Alates of FST are yellowish-brown and 12 to 15 mm long (0.5 to 0.6 inch). There are numerous small hairs on the wings of these comparatively large swarmers. Dispersal flights or “swarms” are massive and begin at dusk on calm and humid evenings from April to July. Alates are attracted to lights, so they are usually found near windows, light fixtures, window sills, and spider webs around well-lighted areas. (Figure 5).

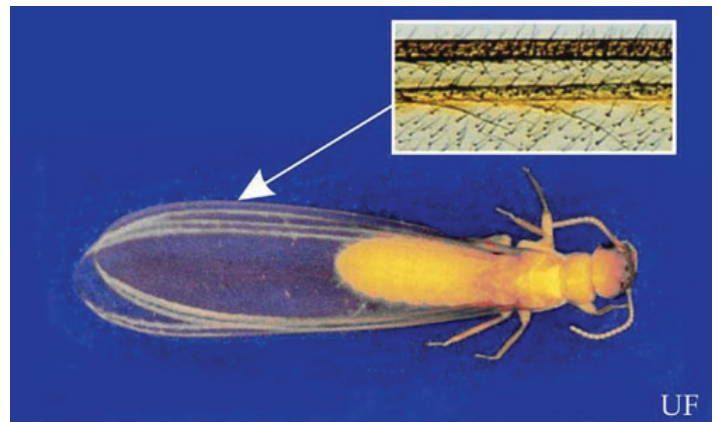


Figure 5. Small hairs on wings of swarmers of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki.

Credits: Rudolf H. Scheffrahn, UF/IFAS

Soldiers of FST have an orange-brown, oval-shaped head, curved mandibles, and a whitish body (Figure 6). When disturbed, soldiers readily attack any approaching objects and may secrete a white gluey fluid (called defensive secretion) from a large opening (called fontanel) in the head.

There are more soldiers (10% to 15%) in an FST colony than that of the native subterranean species in Florida (1% to 2%). Because the FST colony contains a larger soldier proportion than native subterranean termites, infestations with many soldiers is a clue to its presence.



Figure 6. Soldiers (orange-brown, oval-shaped head) and workers of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki. Credits: Nan-Yao Su, UF/IFAS

Life History

A single colony of *Coptotermes formosanus* may produce over 70,000 alates. After a brief flight, alates shed their wings. Females immediately search for nesting sites with males following closely behind. When the pair finds a moist crevice with wooden materials, they form the royal chamber and lay approximately 15 to 30 eggs. Within two to four weeks, young termites hatched from the eggs. The reproductives nurse the first group of young termites until they reach third instar (Figure 7). One to two months later, the queen lays the second batch eggs, which will be eventually nursed by termites from the first egg batch. It may take three to five years before a colony reaches a substantial number to cause severe damage and produce alates.

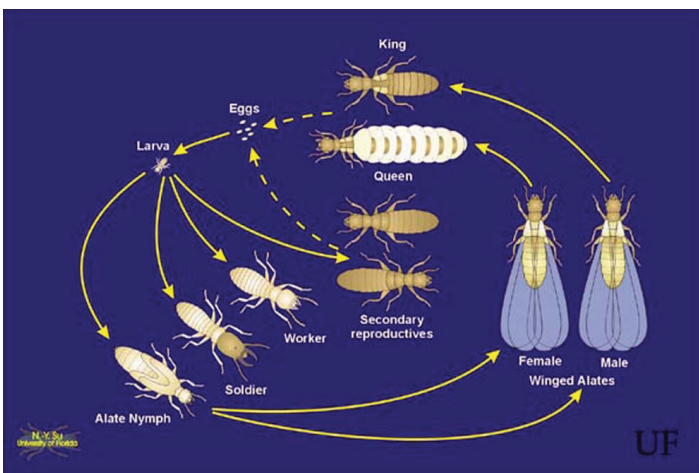


Figure 7. Life cycle of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki.

Credits: Nan-Yao Su, UF/IFAS

Damage

A single individual of the FST does not consume more wood than a single native subterranean termite; however, because of its large population size, an FST colony can cause more structural damage in a shorter time. Wood products that are infested by FST may be recognized by tapping the wood with a hard object. In severe infestations, FST hollows out wood, leaving a paper-thin surface. A hollowed wood surface may look blistered or peeled (Figure 8).



Figure 8. Blistered wood surface damage caused by the Formosan subterranean termite, *Coptotermes formosanus* Shiraki. Credits: Nan-Yao Su, UF/IFAS

Another characteristic of FST is carton nest material that is made of termite excrements, chewed wood, and soil. Carton nests (Figure 9) are usually found in structure voids such as between walls and beneath sinks.



Figure 9. Carton nest of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki. Credits: Nan-Yao Su, UF/IFAS

The Formosan subterranean termite generally invades structures from the ground. They commonly enter through expansion joints, cracks, and utility conduits in slabs. Any wood-to-ground contact is an inviting entrance for Formosan subterranean termite infestations. In some occasions, however, Formosan subterranean termite can form colonies

that are not connected to ground, called aerial colonies. If a pair of alates successfully finds suitable conditions, i.e., adequate food and moisture sources in a building, they can initiate a colony with no ground connection. The flat roofs of high-rise buildings, because they always pool rainwater, are ideal places for the Formosan subterranean termite to initiate aerial infestations if portals of entry are found. Our survey data indicated that more than 25% of the infestations found in the urban southeastern Florida are caused by aerial colonies (Su and Scheffrahn 1987).

Studies also found that Formosan subterranean termites attack many species of living plants. The Formosan subterranean termite attacks structural lumbers and living plants because they are sources of cellulose. However, this termite is also known to attack non-cellulose materials such as plaster, plastic, asphalt, and thin sheets of soft metal (lead or copper) in search of food and moisture. Their highly publicized ability to penetrate solid concrete is a fallacy. However, the Formosan subterranean termite is persistent in finding small cracks in concrete, which they enlarge and use as foraging routes.

Pest Status

Although their distribution in the United States is more restricted than other subterranean termites, such as *Reticulitermes* species, *Coptotermes formosanus* can cause substantial economic loss in infested areas. In the city of New Orleans, where this termite species was introduced in the 1950s, the control and repair costs due to FST is estimated at \$300 million annually (Suszkiw 1998). It is considered the single most economically important insect pest in the state of Hawaii. As the populations grow, economic loss caused by this termite species in more recently established areas will approach the pest status experienced in New Orleans and Hawaii.

Management

Preventive Practice

Wood pressure-treated with preservatives (creosote, pentachlorophenol, inorganic salts such as alkaline copper quaternary or ACQ, etc.) are required by building codes for use at the point of wood-soil interface, primarily to prevent fungi decay. The FST does not damage pressure-treated wood but is capable of bypassing the treated wood to infest untreated wood in structures. The combination of water and wood or other cellulose materials provide attractive conditions for the FST. Leaky plumbing, air conditioning condensate, and any portion of the building that may

collect excessive amounts of moisture should be corrected to maintain an environment less attractive to FST.

Soil Treatment

The conventional method for control of subterranean termites, including the Formosan subterranean termite, is to place a chemical barrier between termites and the structure to be protected. Currently available (as of January 2019) termiticides include: permethrin (Dragnet® FT, etc.), cypermethrin (Demon® TC, etc.), bifenthrin (Biflex® FT, etc.), imidachloprid (Premise®, etc.) chlorfenapyr (Phantom®), chlorantraniliprole (Altriset®), and fipronil (Termidor®, etc.). Pyrethroids such as permethrin, cypermethrin, bifenthrin and fenvalerate repel termites from treatment barriers, while other termiticides prevent termite invasion by lethal contact. For preconstruction treatment, soil termiticides are applied onto sub-slab soil before the foundation is poured. Post-construction treatment can be done by drilling holes through slabs and injecting insecticides under foundation, and by drenching trenches dug in soil along building foundations.

Population Control Using Baits

Because of the large size of a Formosan subterranean termite colony, application of soil termiticides beneath a structure usually do not impact the overall population of several million termites that inhabit galleries extending up to 300 ft. Laboratory studies showed that soil termiticides may kill some termites but most termites in the colony would survive. They would avoid treated soil and may reinvade the house (Su 2005, Chouvenc 2018). Termite baits were developed to address the shortcomings of soil termiticide treatments, especially when facing the Formosan subterranean termite colonies with large population sizes (Su 2019). One such bait product, the Sentricon® Termite Colony Elimination System, uses a durable bait, Recruit® HD, that contains a chitin synthesis inhibitor (CSI), noviflumuron. CSIs do not kill termites immediately after bait consumption. Instead they disrupt termite molting, which occurs approximately every 45 days. (Figure 10B).

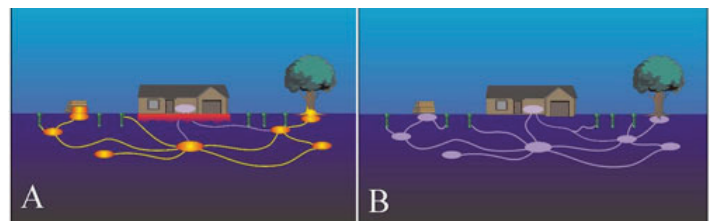


Figure 10. Termites feed on CSI baits and transfer the baits to other member of the colony (A) until most of the colony member receive lethal doses of CSIs, resulting in the collapse of the colony (B).

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