



# Formosan Subterranean Termites

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**F**ormosan subterranean termites are wood-destroying insects native to Central America and the Far East that have been introduced into the United States. They are considered one of the most aggressive and economically devastating termite species in the country.

Like other subterranean termites, Formosan termites feed on materials that contain cellulose, but because of their large colony size, they attack a greater variety of wood at a faster rate than do native subterranean termites. They have an enormous reproductive capacity and a typical colony may exceed 1 million insects.

Although considered "subterranean" (underground, hidden) in habit, the members of the genus *Coptotermes* regularly construct aerial (above ground) nests within the structures that they infest. The possibility of both a subterranean nest close to the infested structure and an aerial nest within the structure can greatly increase the damage potential of these termites.

## Distribution

The first infestations of Formosan termites in Texas were discovered in 1956 around the Houston Ship Channel in Pasadena, Harris County. Since then, Formosan termites have been detected in at least 25 counties in Texas, with more being added each year. There have been reports of Formosan termite infestations in all the major metropolitan areas in Texas. It is believed that Formosan termites were transported to the Houston Ship Channel in wooden shoring timbers from the Far East.

Although there is little chance of encountering Formosan termites outside the upper Gulf Coast region, homeowners and pest management professionals should watch for isolated infestations anywhere in Texas. Shoring timbers and recycled railroad ties are often taken from docks and railways and used for construction of terraces or backyard planting beds. This wood is thought to be the primary mechanism for spreading the Formosan termite in Texas.

Creosote treatment frequently does not reach the core of these timbers and by itself is no guarantee against Formosan termites. These timbers must be properly fumigated to prevent termites from traveling within them and infesting the soil at a landscaping site.

Cargo pallets that have rested on infested soil as well as mulch and sod from infested areas have also spread the Formosan termite into Texas. It is important to limit the spread of Formosan termites because initial infestations in a city can become seed colonies and lead to structural infestations.

## Identification

Formosan termites are social insects. Three forms, called castes, are found in the colony—reproductives (winged or wingless), soldiers and workers (pseudergates). Soldiers and winged reproductives (alates) are the castes used for identification purposes. Figure 1 shows the life cycle of the termite.

**Winged reproductives (swarmers):** Winged Formosan termite reproductives or "swarmers" are yellowish brown and 12 to 15 mm long (0.5 to 0.6 inch) (Fig. 2). They swarm at night in late May and early June and are attracted to lights. They have a dense covering of hair on their transparent wings. Some drywood termites are also a honey-brown color and are about the same size as

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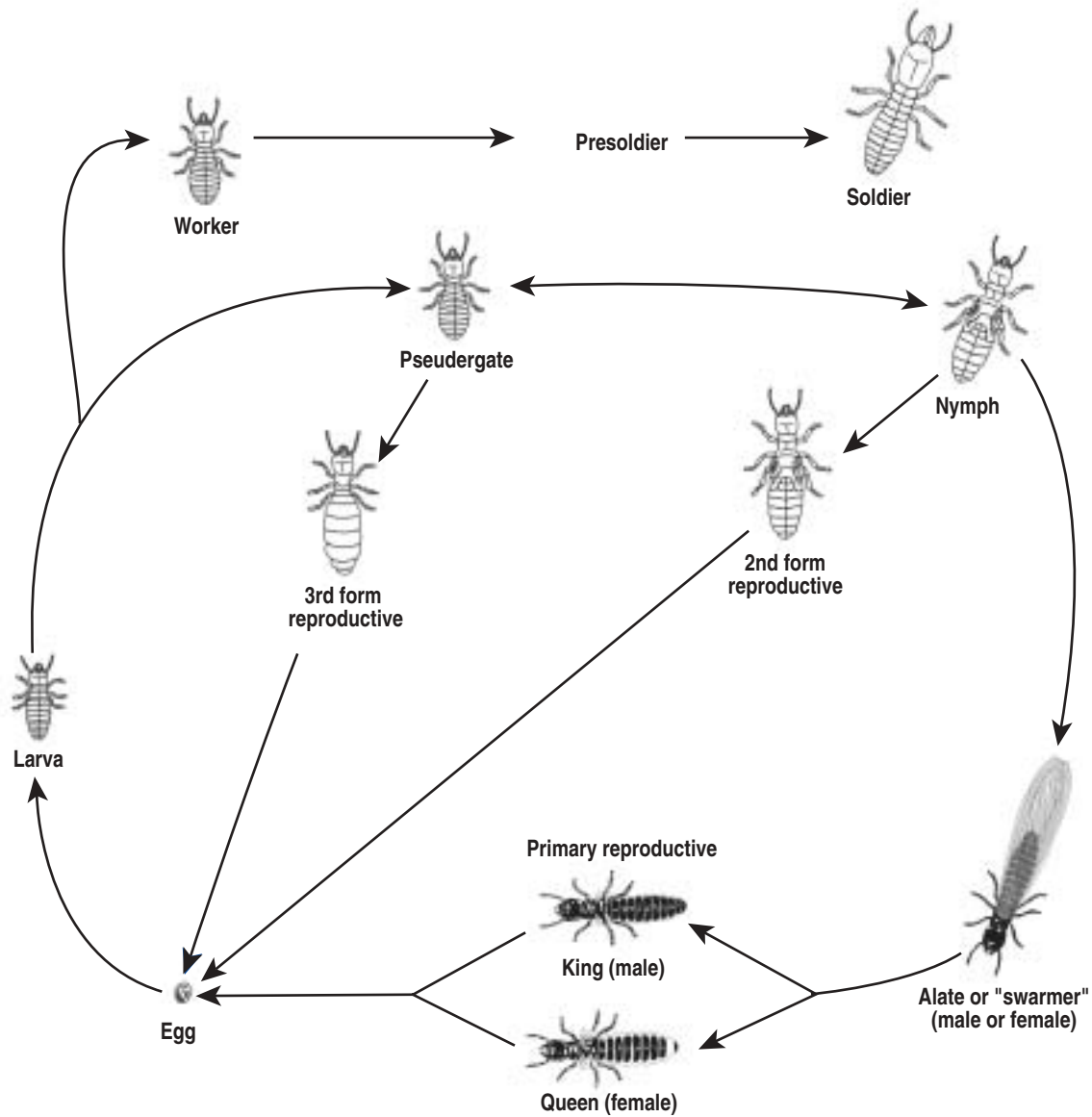


Figure 1. Termite life cycle.



Figure 2. Swarmer Formosan termite.

Formosan termites. (See Texas Cooperative Extension Leaflet E-366, "Drywood Termites"). They, too, swarm at night and are attracted to artificial lights. The two species can, however, be distinguished by identifying features such as veins in

the wings and characteristics of the head (Fig. 3). If identification is in doubt, the termites should be submitted for identification to Center for Urban and Structural Entomology, 2143 TAMU, College Station, TX 77843-2143, (979) 845-5855.

**Workers:** Workers of Formosan termites are white to off-white and are difficult to distinguish from other termite species (Fig. 4). Therefore, soldiers or reproductive caste termites are needed for proper identification. Although ants often swarm at the same time of year as do termites, it is easy to distinguish ants from termites by the shape of their bodies, wings and antennae (Fig. 5).

## Biology and habits

Formosan subterranean termites belong to the same family as native subterranean termites (*Rhinotermitidae*). They construct their primary nests in the soil with a fecal material called "car-

ton" (Fig. 6). When they infest a structure, they can form this carton in the wall spaces (Fig. 7). Formosan termites often live for months or even years on the moisture in the carton material while they feed on wood in the above-ground portions of a structure. If the colony is separated from its

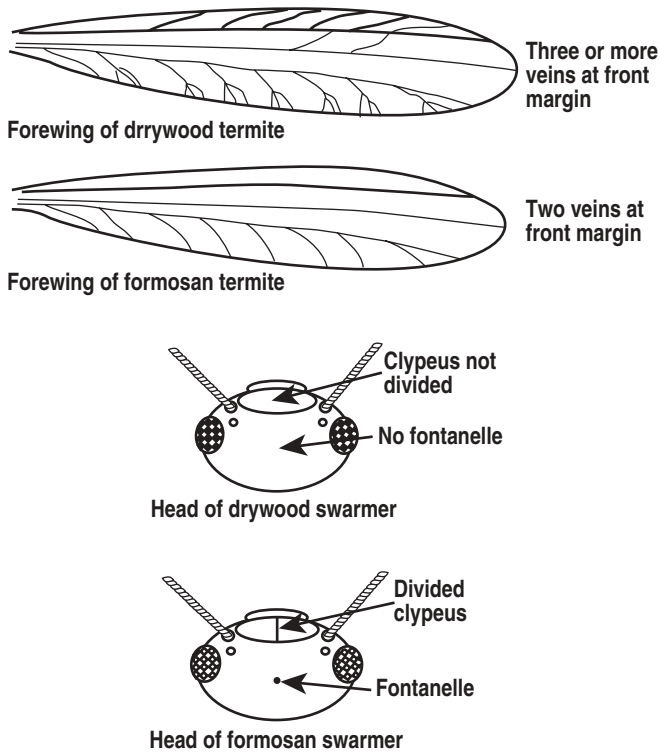


Figure 3. How to distinguish Formosan and drywood termites.



Figure 4. Workers and soldier termites.

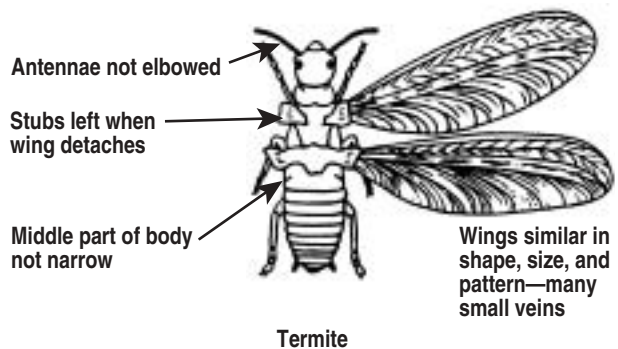
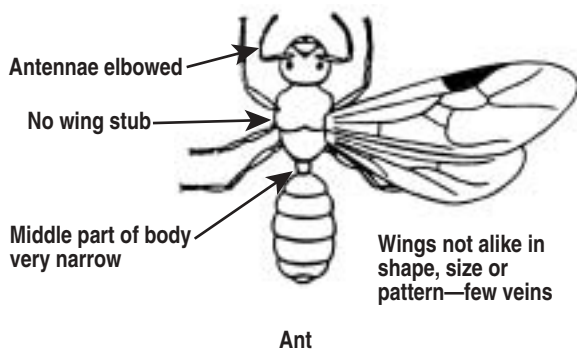


Figure 5. A comparison of an ant and a termite.

subterranean nest, this aerial nest can still survive and the termites will continue to damage the structure.

**Soldiers:** Formosan termite soldiers have tear-dropped, or egg-shaped, heads compared to the more rectangular head of native subterranean termites (Fig. 8). Formosan termite soldiers are more aggressive than are native subterranean termite soldiers and, when disturbed, exude a small amount of a white defensive secretion from a gland called the fontanelle, located on the front of the head. They can also attach themselves to a finger with their mandibles (mouthparts).

When new nests and foraging areas are established, the colony can expand rapidly. Like other termites, Formosan termites workers feed on cellulose in structures and living plants. They have been known to attack more than 50 tree species, including citrus, wild cherry, cherry laurel, sweet gum, pecan, cedar, willow, wax myrtle, Chinese elm and white oak (Fig. 9). Although native subterranean termites generally feed on the softer wood produced during spring growth, Formosan termites eat both early and late season wood (Fig.10).

The damage resembles that of drywood termites but lacks the fecal pellets in the feeding galleries; however, like native subterranean termites, damaged wood is associated with mud-like carton material. Like other subterranean termites, when searching for food and moisture, they may chew through non-cellulose material, such as asphalt, plaster, creosote, rubber and plastic.

## Signs of infestation

The presence of mud shelter tubes, swarmer termites, shed wings or damaged wood are all signs of an active termite infestation. This evidence may be inside or around a structure.

**Swarmers:** The most common sign of a termite infestation is swarming reproductive termites on window sills or near indoor lights. Formosan termites swarm at night and are attracted to lights; native termites swarm during the day. The pres-



Figure 6. Carton nest from Formosan termites.



Figure 9. Damage to a tree.



Figure 7. Formosan termite-produced carton nest in a wall.



Figure 10. Termite damage in wood.



Figure 8. Soldiers of the Formosan termite (top) can be distinguished from other, native subterranean termite species by their teardrop-shaped head capsule. Note the rectangular shape of the native *Reticulitermes* termite on the bottom (magnified 50x).

ence of Formosan termite swarms indicates a nearby colony and suggests that they may be attacking a nearby building or tree. Swarmers inside a house are strong evidence of an active infestation. They are attracted to windows and will leave wings there that can be used for identification.

**Shelter tubes:** Shelter tubes constructed of "soil" rise from the soil up the side of a foundation and indicate a subterranean termite infestation (Fig. 11). When broken open, the active tubes will be filled with termite workers and soldiers.

**Damaged wood:** Wood damage is often not apparent but indicates the current or past presence of termites. Frequently, damaged wood may be hidden under a coat of paint; this wood will sound dull when tapped with a hard object. Wood damaged by Formosan termites resembles wood damaged by other subterranean termites in that it will contain soil deposits.

**Nests:** Formosan termites often make aerial nests of chewed wood, soil, saliva and fecal material. These nests can be as large as several cubic feet and can be found both in the soil and above ground level. These nests will not generally be discovered in buildings unless the wall coverings are removed. Subterranean nests are usually located away from structures and can be difficult to find.



Figure 11. Shelter tube of an active termite colony.

## Management

Control measures include reducing the potential for subterranean termite infestation, preventing termite entry and applying residual liquid chemicals or baits for remedial treatment. However, management techniques differ from those used for other subterranean termite species because of the likelihood of aerial nests.

## Inspection

A thorough inspection can determine whether termite infestations and damage are present, whether control measures are needed and whether there are any conditions that might encourage termite attack (conductive conditions).

Professionals who know the basic construction elements of buildings, the environmental requirements for termite survival and the behavior of this and other subterranean termites are best equipped to perform inspections.

Tools and equipment needed for an inspection may include a flashlight, ice pick or sharp-pointed screwdriver, ladder and protective clothing (bump cap, coverall, rubber knee pads). A clipboard, graph paper and floor plan or sketch help document the findings of the inspection and to ensure that the entire structure has been examined. A moisture meter can detect increased moisture in walls that might indicate conducive conditions, the presence of termite shelter tubes or hidden carton nests. Other termite detection equipment may include fiber optic boroscopes, acoustical detectors, motion detectors, X-ray technology, infra-red cameras and methane detectors. Such equipment can be useful but does not guarantee detection of all termites or their damage to a structure.

**Where to check outside.** The inspector should examine the foundation of the house,

garage and other structures for shelter tubes coming from the soil (Fig. 11).

Areas to check:

- Attached porches, connecting patios, sidewalks, areas near kitchens or bathrooms and confined or hard-to-see places.
- The soil moisture around or under the foundation to determine if faulty grade construction creates moist areas next to the structure.
- The areas around windows and door frames, and where utilities (such as air conditioning pipes, gas and electric services enter the structure).
- Roof eaves and gutters for defects that might cause leaks and wood rot.
- Areas behind closely planted, dense shrubbery or foliage.
- Any areas where earth contacts wood, such as fences, stair carriages or trellises.

**Where to check inside.** The inspector should check the interior walls for shelter tubes (Fig. 12). A moisture meter is extremely helpful in locating nests hidden in wall spaces and ceilings. Discoloration or staining on walls or ceilings may indicate water leaks that decay wood and attract termite infestation. The inspector should probe doors and window facings, baseboards and hardwood flooring, being careful not to deface finished wood.

Other areas to check:

- Attached, earth-filled porches, known or suspected joints, cracks or expansion joints in the foundation, and unusual blistering in paint or wallboard surfaces.
- Areas where plumbing or utility pipes enter the foundation or flooring or pass through the foundation walls.
- The floor covering for raised or split areas.
- Plumbing, particularly in bathrooms on slab construction **The bath trap area should have an access. If none exists, a remov-**



Figure 12. Shelter tubes on interior walls.

**able plumbing hatch should be built for periodic inspections.**

- The attic for shelter tubes, water leakage, wood rot or damaged wood.
- Areas underneath or close to earth-filled porches, patios, planters and bathrooms for water leakage and termite damage
- The top of the foundation wall where the floor and the wall intersect.
- The inside of beams, chimney bases, hearths or piers.
- The crawl space between the floor and the underlying soil (if the house is of pier and beam construction). Crawl spaces should have a minimum of 18 inches between floor joists and the underlying soil, and at least 12 inches between floor beams. Standing water underneath the house will require remediation.

## Preventive measures

Prevention is the best management tool against Formosan termites. The best time to protect against any termite species is before and during construction. A liquid insecticide should be used as a pre-construction treatment of the soil beneath and around the foundation. Insist that the contractor or architect specify the application of termiticide before the slab is poured. This is the one time in the life of a structure when the soil beneath the slab can be protected against termites. This pre-construction treatment will be effective for several years, but over time the surrounding soil will need retreatments.

A complete pre-treatment must include **all soil** under the slab as well as the trenching and outside perimeter after the final soil grade is established. Treating the plumbing penetrations alone is only a partial treatment.

Once the foundation is completed, all form boards and stakes should be removed. There should always be at least 6 inches of exposed foundation between the soil and bottom edge of any siding material, especially stucco. This will permit a thorough inspection for termite activity. During construction, avoid placing any siding or insulation material in contact with the soil or below grade.

Using pressure-treated lumber in critical areas may help prevent termite infestation. Pest management professionals have also commonly recommended borate treatments of the framing lumber. Though this may be beneficial, it is not considered a "full" pre-construction treatment. Termite baits have been approved for pre-construction use in Texas (in lieu of a pre-treatment), but this is not a recommended method for protecting structures against termites.

## Remedial treatment

Several options are available for the remedial treatment of Formosan termite infestations: barrier treatments, baiting programs and tent fumigation. These methods may be used alone or in combination.

**Barrier treatments.** The purpose of this type control measure is to establish a barrier of treated soil around a foundation's perimeter and at the point of any penetrations through slab foundations. Spot treatments of less than 10 square feet may not stop Formosan termites from gaining access elsewhere in the structure. Even a thorough treatment around the perimeter of the foundation and all plumbing penetration may not be successful if termites can enter through hidden cracks in the foundation. All possible entry points should be found and treated.

Formosan termite colonies are large, and they are persistent about gaining access. Structures should also be thoroughly inspected to discover and eliminate moisture sources termites could use to build aerial nests. The aerial nests, or carton, should be located and removed. Again, a moisture meter can be a valuable tool in locating aerial nests.

**Fumigation.** Fumigation is the use of a toxic gas to penetrate the wooden parts of a structure and kill the termites. Only professional pest control specialists are certified and licensed to perform fumigations.

Because no pesticide remains to control or prevent infestation once fumigation is complete, this method must be combined with soil treatment to prevent reentry of termites from the soil.

To control Formosan termites, the following steps must be performed before fumigating.

1. Establish a chemical barrier in the soil around the foundation of the infested structure.
2. Treat all entry points such as plumbing penetrations and cracks in the foundation with liquid termiticide.
3. Remove all carton nest material from the structure.

Once these steps are complete, fumigate the structure following all labeling requirements.

**Baits.** Termite baiting systems have recently become available as alternative or supplemental treatments for Formosan termites. Baiting relies on a food source (such as wood) mixed with a slow-acting insecticide that can kill the members of the termite colony. This concept is similar to one used to control fire ants. Foraging termites eat the bait and return to share it with the other termites in the colony.

Baits can be highly effective on Formosan termites because they feed aggressively, but the termites must find and eat the baits before they can have any impact on colonies that feed on the home. Above-ground baits are placed in contact with mud shelter tubes or other locations where the termites

are actively feeding on wood. Within a few days, the termites should begin to eat bait and transfer it throughout the colony.

Baits also may be placed in the soil surrounding the structure; however, the feeding on in-ground baits is variable and may require several months to years. Pest control specialists understand termite biology and behavior and can install the baits correctly, then monitor the process through frequent visits.

Formosan termites consume food at a high rate so baits must be inspected frequently. Bait stations should always contain fresh bait. As the number of termites declines (after several months), the interval between bait inspection and replacement can usually be extended. Each bait product will have specific directions that must be closely followed. Some baiting systems are used in combination with liquid termiticide applications and generally require several site visits for installation and monitoring. Control may take from a few months to more than a year. When combined with residual insecticide treatments, baiting can be an effective way to treat Formosan termite infestations.

## **Treatment of infested trees**

A tree infested by Formosan termites must be treated to eliminate the infestation and prevent further damage, structural weakness or death of the tree. Infested trees can spread termites to other structures if the wood is recycled and used as mulch. Applying termiticide to the tree bark will generally not control Formosan termites (Fig. 9).

To treat a Formosan termite infestation in a tree, holes must be drilled above the soil line to locate

the void area in the nonliving heart wood of the trunk. Voids in major limbs and branches must also be located. This may require several exploratory drill holes. An appropriate insecticide must then be injected into the voids. Foam formulations of termiticides are especially effective as they expand within the void spaces and provide a more thorough application of the termiticides.

## **Keys to management of Formosan termites**

Formosan subterranean termites pose significant potential for structural damage and expense. They are spreading to new areas of Texas and will cause more damage over time. It is important, therefore, that a homeowner use the proper techniques to manage these termites, including:

- Accurate, positive identification of the soldiers or winged reproductives.
- Thorough knowledge of their biology and behavior.
- A comprehensive inspection.
- An aggressive treatment program.
- Meticulous, annual inspections to detect evidence of termite activity.
- Preventive management measures, such as maintaining a gap between soil grade and building materials.

For further information on termites, see bulletins E-368, "Subterranean Termites" and E-366, "Drywood Termites," and the Web site: <http://termites.tamu.edu>.

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Revision