



Termites and Other Pests in Paradise

J. Kenneth Grace

Department of Plant and Environmental Protection Sciences

Along with the steady stream of cargo ships, military traffic, and tourists visiting Hawai'i have come many unwanted alien plant, animal, and microbial species, including insect and weed pests, plant disease pathogens, and the obnoxious coqui frog. This is why agricultural inspections are in effect for both entry to and departure from the state. Two significant successes of these quarantine measures to date have been the effective exclusion of snakes (Hawai'i has none) and the prevention of spread of fruit flies from Hawai'i to the U.S. mainland.

The Hawai'i Department of Agriculture estimates that about 15 new insects are introduced to the state each year. For over 100 years, state entomologists and pest management specialists have relied on biological control (the introduction of beneficial insects to prey on pests) as the primary method of bringing most of these pests of agriculture, natural resources, and ornamental plants under control. However, biological control has been less successful in managing structural pests such as cockroaches, ants, and termites, although we do have a few beneficial wasps that attack cockroaches. With year-round warm temperatures and a constant influx of new insect visitors, Hawai'i's pest management sector truly has its work cut out for it!

Eeek...ants

Approximately 50 introduced ant species now call Hawai'i home, including common pests such as the Argentine ant, bigheaded ant, glaber (or black) ant, pharaoh ant, and ghost ant. In mid-2010, the odorous house ant was found for the first time on the island of Maui. Although the red imported fire ant has not yet made its way across the Pacific, Hawai'i is home to the related tropical fire ant and also the little fire ant, currently found

only on the island of Hawai'i and in one location on the island Kaua'i. The Hawaiian carpenter ant is the largest ant in the islands; although it does little actual damage to wood, it nests in hollow spaces and startles homeowners with its nightly foraging activities.

Eeuw...cockroaches

About 20 cockroaches have also found their way to Hawai'i, including the German, American, and (equally large) Australian cockroaches. The Asian cockroach is often mistaken for a German cockroach, but it usually lives outside and is capable of sustained flight. The jewel-like harlequin cockroach, thought to have been spread around the world by Spanish galleons, also lives outside. The Surinam cockroach is thought to have been the first cockroach introduced to Hawai'i; it is unique in being one of the only cockroaches to regularly host a disease agent: eyeworm of poultry, which can be a serious problem in chickens. Oddly, the Oriental cockroach is about the only ubiquitous world pest species not yet found in Hawai'i, probably because it favors cooler climates.

Aargh...termite\$

When it comes to termites, Hawai'i is known worldwide as a home of the notoriously destructive Formosan subterranean termite (FST), but it is also a center of research on termite biology and management. This pest was probably introduced to Hawai'i by boats from southern China at the end of the sandalwood trade period in the early 1860s. It was first recognized in Hawai'i and described by an entomologist shortly after the turn of the 20th century, and it is estimated to cost residents of Hawai'i over \$100 million each year. During the last half of the 20th century, it spread throughout the subtropical regions of the world, as is all too apparent to residents of

the Gulf coast! For more information on the Formosan subterranean termite, see *The Formosan Subterranean Termite in Hawaii* (www.ctahr.hawaii.edu/oc/freepubs/pdf/HSP-2.pdf).

Hawai'i is also the longtime home of two drywood termite species that live largely outside in fallen wood or dead limbs on trees: the large forest tree termite (*Neotermes connexus*), and the lowland tree termite (*Incisitermes immigrans*). The latter is interesting because it is a close relative of the western drywood termite found infesting numerous structures in California, but it has only rarely been found in buildings in Hawai'i.

The worst drywood termite pest in Hawai'i is the West Indian drywood termite (*Cryptotermes brevis*), also sometimes called the powderpost drywood termite in parts of the USA. This termite almost exclusively infests seasoned wood; it probably came to Hawai'i with the early Polynesian settlers, although transport on later ships is also possible.

More termites!

During the past 15 years, the number of termite pests found in Hawai'i has doubled from the four described above. We now have eight termite species established in Hawai'i, although the four newcomers are still very limited in their distribution in the islands compared to the original termite residents. These four recent immigrants include the Pacific dampwood termite (*Zootermopsis angusticollis*), the western drywood termite (*Incisitermes minor*), the Indo-Malaysian drywood termite (*Cryptotermes cynocephalus*), and the Asian subterranean termite (*Coptotermes gestroi*).

The Pacific dampwood termite is found only at higher elevations on Maui at this point. It was apparently imported in logs used by a local resident to make Hawai'i's unique musical instrument, the ukulele (or "jumping flea"). The western drywood and Indo-Malaysian drywood termites are also very limited in their distribution: both are found only on O'ahu, and only in a few locations so far. Both of these are severe structural pests in other parts of the world, however, so it's likely that they will gradually expand their range on the island.

The final recent discovery in Hawai'i has been the Asian subterranean termite (AST), which is found in southeast Asia, the Philippines (where it was thought until recently to be an island native), Guam, Taiwan, the Caribbean, and southern Florida. Although the AST was first found in Hawai'i in 1963, in a house near the

Mānoa campus of the University of Hawai'i on Oahu, it was never found again until the late 1990s, when it appeared in military housing (and nearby civilian houses and trees) and buildings on the leeward (western) side of Pearl Harbor. Since the first discovery in 1999, the AST has continued to slowly spread into surrounding housing areas. Given that this termite is ubiquitous in both the Philippines and Guam, it can be expected to continue to spread on Oahu and eventually to the neighbor islands.

Research at UH-CTAHR (the College of Tropical Agriculture and Human Resources at the University of Hawai'i at Mānoa) has found some unique differences between the Formosan and Asian subterranean termites. Among other differences, the AST is less aggressive than the FST, dries out more quickly (which might explain why it is usually found closer to the equator than the FST), eats a bit slower, and exhibits very different tunneling patterns in the soil. While the FST tends to dig rather large, straight tunnels while searching for food, the AST has a finer and multi-branched network of tunnels, similar in appearance to a mosaic or jigsaw puzzle. Despite these differences, both termites are voracious pests, which means double-trouble for Hawai'i!

For more information on identification of Hawai'i's termites, see *Hawaii's Termites—An Identification Guide* (www.ctahr.hawaii.edu/oc/freepubs/pdf/HSP-1.pdf).

Preventative termite control in new construction

Many of the methods used to control subterranean drywood and subterranean termites in Hawai'i have grown out of research at UH. Hawai'i is unique among the states in requiring that all structural wood in buildings be either from a naturally durable timber or treated with a wood preservative to prevent decay and termite attack. Based on CTAHR research, borates are the most popular wood preservatives in use. Steel framing has replaced a lot of the wood used in building construction, and plastic fencing has become popular.

In addition to baits and soil termiticides (tested by CTAHR since the 1950s), physical barriers to termite penetration are quite popular in Hawai'i. The basaltic termite barrier (BTB) was developed by Minoru Tamashiro and is often installed as a layer beneath the concrete foundation slab of new buildings. It was first used in state government construction and is now used in many residential homes. Crushed basalt (volcanic rock) is screened to a particle size that is too large for termites

to grasp in their mandibles and move, and which packs too well for them to find air spaces to move through. So long as it is not disturbed, it forms a permanent physical barrier to invading termites. Innovative pest management firms have added additional protection to structures in the form of perimeter termiticide treatments.

Termimesh, a stainless steel wire mesh termite barrier, is also used extensively in construction in Hawai'i. Electrical utilities place a "sock" of Termimesh over the bottom of poles before placing them in the ground.

Education about termites

Currently, CTAHR entomologists are engaged in a large-scale public school curriculum program—"Educate to Eradicate"—to teach the next generation of homeowners how to prevent termite damage, while simultaneously increasing the science literacy of Hawai'i's students. This project, tied to termite-management seminars for adult residents as well, has been developed in cooperation with the USDA Agricultural Research Service and has reached thousands. For more information, go to www2.hawaii.edu/~entomol.

Practical tips for homeowners

Ant control

Ants usually (although not always) nest outside the home, and come inside looking for food, so sanitation can help to reduce problems: clean up food spills, and do not leave pet food out for long periods. It is also helpful to trim back any trees or bushes that are touching the building, because ants use the branches as bridges into the home. Researchers have found that a thin stream ("pin stream") of a residual insecticide applied at the base of the foundation, or across any visible ant trails, is just as effective as spraying a lot of insecticide around the yard, and puts much less insecticide residue in the home environment.

Inside the home, commercial bait stations (usually plastic stations containing an insecticide) are effective in reducing ant populations. Liquid ant baits, often containing borax or boric acid in a sugar-water solution, are also effective, although it is best to put out a few new drops of the liquid wherever ants are seen each day for about a week. With baits, it may take several weeks before ants disappear from the home, because ant food preferences change depending on the size and age of the ant colony. If ants are still found even after applying a bait for a week, it's best to switch to a different bait product.

Cockroach control

As with ants, sanitation is also important to prevent cockroach infestations. Pet food is especially popular with some cockroach species. Bait stations are very effective in eliminating cockroaches in the home, although the most common mistake made by homeowners is to put out too few of them. Be generous in placing the bait stations (or glue boards) in bathrooms and kitchens, because food and water are the primary needs of foraging cockroaches. Most bait stations lose their effectiveness after 2–3 months and need to be replaced.

Termite control

Termites usually hide in the ground, and in the wood inside structures' walls. Due to their hidden lifestyle, and the large amount of damage that they can do, homeowners are advised to seek the advice of a pest control professional. Subterranean (or ground) termite danger signs for homeowners are (1) any wood (such as siding or steps) in contact with the ground, (2) wet areas next to or beneath the home, and (3) mud tunnels, usually $\frac{1}{4}$ – $\frac{1}{2}$ inch wide, coming up foundation walls or support piers. Homeowners can also place small wooden stakes into the ground at least 6 inches from the foundation to see if there are any hungry termites in the vicinity.

Subterranean termite treatment is best left to the professionals, as it requires either placing bait stations into the soil around the home (which must be inspected at regular intervals), or injecting insecticide into the ground. Several consumer insecticides are sold for subterranean termite control, and these can be worked into the soil around piers supporting a deck, for example, but they should not be relied upon to protect the entire home. For new additions, homeowners can purchase the Basaltic Termite Barrier (BTB) from local gravel suppliers. For more information on subterranean termite management, see *New Technology for Managing the Formosan Subterranean Termite* (www.ctahr.hawaii.edu/oc/freepubs/pdf/HSP-3.pdf).

Drywood termites live above ground, inside wood in the home, and leave small piles of sand-like fecal pellets. If you look closely above these little piles, you will usually find a small hole in the wood, often with a pellet stuck in the opening. Several insecticide products are available in Hawai'i that come with a small wand to facilitate injection of the insecticide into these small holes, or into holes punched or drilled into the wood to allow the product to reach the termite galleries within.

These insecticides tend just to repel termites (chase them away) and are much more effective in controlling drywood termites inside furniture, or a freestanding door, than termites in wood connected to the walls of the home. Again, it's best to call a professional when any small piles of pellets, or actual wood damage, is found within your home.

An important way to prevent termite damage to your home is to always use wood treated with a wood preservative when you build or remodel. This is required by the county building code authorities in Hawai'i, and treated wood is readily available at local building supply stores. Wood treated with borates (such as Hibor™) should be kept protected from rain, or else well painted, because the preservative can gradually be washed out of the wood if it is exposed to free water. Plastic "wood" and plastic fencing are other alternatives that will last longer than untreated, or possibly even treated, wood when used in the yard.

References

- Woodrow, R.J., J.K. Grace, and J.R. Yates. 1999. Hawaii's termites—an identification guide. www.ctahr.hawaii.edu/oc/freepubs/pdf/HSP-1.pdf. [Note: as pointed out above, new species of termites have arrived in Hawai'i since 1999.]
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- Proceedings, Hawaiian Entomological Society. <http://scholarspace.manoa.hawaii.edu/handle/10125/19>. [The searchable proceedings archive at this site contains over 1500 scholarly articles describing research and observations in all areas of entomological study in Hawai'i and the Pacific.]

Publication titles and URLs are hyperlinked in the pdf file of this publication, available at www.ctahr.hawaii.edu/oc/freepubs/pdf/HSP-4.pdf.

Acknowledgment

An earlier version of this text was published in Pest Control Technology (PCT Magazine), the publisher of which granted permission for this re-use.