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Looking Ahead: 2016

Sept. 23–24, 2016 Board of Directors Red Lion Hotel Redding Redding, California

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THE VOICE OF PEST CONTROL OPERATORS OF CALIFORNIA

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Fraveling Pests in Paradise

By J. Kenneth Grace, Ph.D., University of Hawaii at Manoa

Invasive Species Love Hawaii

Beautiful Hawaii, my home for the past 27 years, has been called the invasive species capital of the world. Quite a distinction for a small group of islands in the middle of the Pacific Ocean, 2,500 miles from the nearest continent! However, about 27 new insects are introduced to Hawaii each year, and many of these are significant pests. Sixty ant species, including the notorious little fire ant, and about 20 different cockroaches now call Hawaii home. Agricultural pests such as the coffee berry borer, first discovered in a Kona coffee field in 2010, represent a continual threat to Hawaii's tropical crops. Although beloved in Puerto Rico, the coqui frog escaped its natural enemies when it migrated to Hawaii, and the resulting large frog populations can be deafening to nearby residents when they sound their mating call in the evenings. And, of course, the Formosan subterranean termite is well-known to beleaguered Hawaii homeowners and to pest management professionals worldwide.

How did this remote island paradise become so popular with invasive insects? Part of the answer lies in its isolation. Before man began to travel the globe, only a small number of insects and plants were able to brave the ocean and air currents to reach Hawaii. These early colonists evolved into unique native species. But, these species evolved without many natural enemies, and also left many ecological niches unfilled. As a result, later invaders transported by man were able to easily eat or out-compete native species, and found unoccupied niches where they could thrive without fear of any natural enemies that they might have left at home.

As Hawaii became a transportation hub for trade, tourism and the U.S. military, invasive species introductions really took off. About 89% of the food consumed in Hawaii, and 98% of all commercial goods are imported. Only a small fraction of these shipments can be inspected, and cryptic insects can be difficult to find. In addition to commercial trade, military traffic brings equipment and other materials that are difficult to inspect thoroughly for insect hitchhikers. New residents and tourists can also bring along uninvited guests.

Once pests reach Hawaii, they find a wonderful home, where the temperature at sea level is about 75 F year round. The islands have incredible environmental diversity too, with rainfall ranging from 20-300 inches within only a few miles. The tropical climate at sea level gives way to cooler temperate conditions as you ascend the volcanic mountains, creating habitats suitable for insects and weeds from many different climate zones around the world.

Termites Come to Hawaii

Prior to the 1860s, only three termite species were found in Hawaii - the West Indian drywood termite, lowland tree termite, and forest tree termite. These are all drywood termites. The West Indian drywood termite is a common pest worldwide of seasoned wood. The other two termites are usually found in stumps or in dead branches on living trees, although the lowland tree termite is considered to be an invasive termite that is expanding its range worldwide, and is occasionally found infesting wood in buildings, particularly rough-cut lumber or rustic trim in Hawaii.

The Formosan subterranean termite, the fourth termite species to reach Hawaii, probably came to Hawaii in ships from southern China in the late 1800s. An 1869 Honolulu

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newspaper article described damage to a fence near Pearl Harbor by "white ants," even though subterranean termites were not officially reported in Hawaii until 1913, when extensive termite damage was found in a Honolulu cathedral.

In the 1990s, four additional termite species migrated to Hawaii, doubling the number of termites to eight. One of these was the Pacific dampwood termite, native to the west coast of North America. This termite is most frequently found in logs or stumps, but it can also attack poorly constructed steps and decks, as termite inspectors in California know.

The other three termite species discovered in Hawaii in the late 1990's all infest buildings, although their distribution in Hawaii is still very limited. These are the Indo-Malaysian drywood termite, western drywood termite, and Asian subterranean termite. The Asian subterranean termite is basically the tropical equivalent of the subtropical Formosan subterranean termite, and Hawaii is one of only three locations in the world where the climate is suitable for both of these worldwide pests. The other two locations where both are found are Taiwan and south Florida.

What Makes a Termite Invasive?

Let's bear in mind that most of the 2,750 described species of termites in the world are not pests and actually do good things, like add nutrients to the soil. Only 7% (183) of all these termites have been recorded as pests of wood in service, trees, or agricultural crops, and only 3% (80) damage buildings and furniture. About 1% (28) of the termites in the world are considered to be invasive species.

So, what makes a termite "invasive," or able to move out of their home region and around the world? These are termites that (1) eat wood rather than grasses or other materials, (2) are able to nest in their woody food source, and (3) can easily produce new kings and queens in the nest so that a group can thrive even if they are separated from their original queen. These characteristics are most common in the drywood and subterranean termite families, which together make up 21 of the 28 species on the list of invasive termites.

The fact that drywood termites live inside one or several connected pieces of wood makes them both very easy to move around, and difficult to detect and control. Often the little six-sided fecal pellets pushed out of their gallery systems are the only evidence of a drywood termite infestation. Termites are capable of using virtually all of the cellulose in wood, and but they defecate the lignin and hemicellulose by each producing about one pellet per day.

The wooden shipping pallets found in nearly every shipyard and warehouse are often infested by drywood termites. Work that we have done mapping the termite galleries in these pallets and testing insecticide injections has shown that drill-andtreat insecticide treatments are literally hit or miss. In some cases, we found a single termite colony tunneling through all the boards in the pallet, but in most cases there many different unconnected termite colonies. Often there were multiple colonies in a single four-foot long 1x6-inch board! This demonstrates the need to drill lots of holes in each board to reach all possible colonies when injecting an insecticide for drywood termite control. Control methods that treat the entire structure, like fumigation or a thorough heat treatment are most reliable.

In contrast to drywood termites, subterranean termites usually live in the soil, with gallery systems often extending over a very large area. However, if a small number of individuals are broken off from the main colony, such as trapped while feeding in a piece of wood above ground, they can persist and develop reproductive capabilities, and then initiate a new gallery system when they once again come in contract with the soil. This flexibility explains how the Formosan subterranean termite has become distributed globally in the subtropics and warmer edges of the temperate regions, and the Asian subterranean termite has spread around the world in the equatorial zone. Although it is not found in Hawaii, the eastern subterranean termite native to North America has also been carried to parts of Europe and South America.

As we continue to travel more and ship goods further and faster around the globe, pest management professionals play an important part in protecting communities from invasive termites and other traveling pests!



Dr. Grace is Associate Dean for Research in the College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa. His interest in termites

and urban pest management began when he was employed in the California pest control industry in 1975-85. He is known internationally for his research on subterranean and drywood termites, ants and other structural pests.



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