

POPULATIONS OF FORMOSAN SUBTERRANEAN TERMITE, *COPTOTERMES FORMOSANUS* (ISOPTERA: RHINOTERMITIDAE), ESTABLISHED IN LIVING URBAN TREES IN NEW ORLEANS, LOUISIANA, U. S. A.

WESTE L. A. OSBRINK, W. DAVID WOODSON, AND ALAN R. LAX

United States Department of Agriculture, Agricultural Research Service, Southern Regional Research Center,
1100 Robert E. Lee Blvd. New Orleans, LA 70124 USA

Abstract - Populations of Formosan subterranean termites, *Coptotermes formosanus* Shiraki, were characterized on a 141,645 m² research facility in New Orleans, Louisiana. 32.7% of loblolly pines (*Pinus taeda*), 12.5% cedar (*Juniperus* sp.), 8.2% live oaks (*Quercus virginiana*), and 4.6% of baldcypress (*Taxodium distichum*) contained Formosan subterranean termites. External signs of termite infestation in the trees, as determined by visual inspection, was rare compared with other sampling techniques. Occurrence of native subterranean termites, *Reticulitermes* sp. in living trees was also documented. Termite activity was shown in 5.6% of 500 ground monitor stakes a 6 month sampling period, 4.8% with *C. formosanus* and 0.8% with *Reticulitermes* sp. Termites compromised the structural integrity of trees, some of which failed under stress. Termites in trees pose a threat to local building structures.

Key words - Tree sampling, *Reticulitermes*

INTRODUCTION

The Formosan subterranean termite, *Coptotermes formosanus* Shiraki, was introduced into the United States in the thousands of tons of wooden military cargo crates, pallets, and dunnage shipped back from the Asian theater following World War II (La Fage, 1985). New Orleans, Louisiana was one of the most active ports of entry. Populations of Formosan termites flourished in the warm humid climate of New Orleans, virtually blanketing the city over the last half century. Where it occurs, *C. formosanus* is the most destructive subterranean termite in the world. In New Orleans, Formosan termites are responsible for \$66 million a year expenditures in structural repairs and \$37.5 million a year annual cost of chemical treatments.

C. formosanus commonly infests living urban trees greater New Orleans. These infestations go undetected until the termite population in a tree becomes so great as to cause: 1. Structural failure of the tree, 2. External signs such as mudding of cut or broken limb scars become apparent, or 3. The appearance of dispersal flight launching tubes during swarming season. Detecting and understanding these hidden termite populations in trees is critical because of the danger of falling trees, the aesthetic and historic importance of trees to greater New Orleans, and the threat of these termite populations moving into and destroying urban structures. The objective of this research was to quantify the living trees in which *C. formosanus* occurred at the Southern Regional Research Center in New Orleans, Louisiana, U.S.A.

MATERIALS AND METHODS

Monitoring

The Southern Regional Research Center (SRRC) occupies 141,645 m² and is located at the north east corner of City Park, New Orleans, Louisiana, U.S.A. Trees were identified to species and inspected for termites in three ways: 1. Visual inspection which consisted of examining a tree for signs of tubing on the bark and mudding over cut or broken branch scars, 2. Least destructive sampling which was accomplished by prying bark away from the base of the tree trunk on each of four sides with a wood

chisel, and 3. Staking, which consisted of placing pine stakes (2 x 4 x 20 cm) on opposing sides of the base a tree. The perimeter of 3 buildings and 6 transects across an expanse of lawn were also surveyed with monitoring stakes at 4 meter intervals. A total of 500 monitoring stakes were placed. When a stake became infested with termites it was replaced with a bucket monitoring trap (Su and Scheffrahn, 1986). Stakes were examined monthly.

Monitoring results of the combined tree and stake survey were analyzed using Radial Basis Functions with the multiquadrics function to produce regularly spaced arrays of Z values (termite observations) from irregularly spaced XYZ surface plots to create a contour map of termite population foci (Surfer, 1997).

Park tree survey

Late September, 1998, high winds accompanying the passage of hurricane George near New Orleans caused many trees to fall or split. Damaged trees were surveyed for termite damage in City Park, New Orleans. City Park is a 6 km² recreational facility consisting of three golf courses, a museum, multiple sport fields, picnic areas, and forested areas. All damaged trees were identified to species when possible and examined for termites.

RESULTS AND DISCUSSION

Monitoring

Sampling began with a tree survey and placement of monitoring stakes at the beginning of August 1998. Stakes were checked monthly for 6 months through January 1999. The following trees were sampled (common names, genus and species, family, and number sampled): Live Oak, *Quercus virginiana* Mill, Fagaceae, 49; Loblolly Pine, *Pinus taeda* L., Pinaceae, 49; Baldcypress, *Taxodium distichum* Rich., Pinaceae, 66; Cedar, *Juniperus* sp., Pinaceae, 8; and Crapemyrtle, *Lagerstroemia indica* L., Lythraceae, 12.

Loblolly Pine had the highest incidence of termite infestation with 32.7 % infested with *C. formosanus* and 4.1% with *Reticulitermes* sp. (Table 1, Fig. 1). Shelter tubes from *C. formosanus* were present on the bark surface of one pine tree (2.0%) and none from *Reticulitermes* sp. Cooper and Grace (1987) found no living *Pinus* sp. with *Reticulitermes flavipes* shelter tubes in Toronto, Canada,

Table 1. Live trees attacked by subterranean termites at the Southern Regional Research Center, New Orleans, Louisiana, U.S.A.

TREE	(N)	<i>Coptotermes formosanus</i>			<i>Reticulitermes</i> sp.				
		VISUAL	L.D. ¹	STAKE	TOTAL	VISUAL	L.D.	STAKE	TOTAL
OAK	(49)	1 (2.0%) ²	3 (6.1)	6 (12.3)	6 (12.3)	0	0	0	0
PINE	(49)	1 (2.0)	14 (28.6)	5 (10.2)	15 (30.6)	0	2 (4.1)	2 (4.1)	2 (4.1)
CYPRESS	(66)	2 (3.0)	2 (3.0)	3 (4.6)	3 (4.6)	0	0	0	0
CEDAR	(8)	0	0	0	0	0	0	1 (12.5)	1 (12.5)

¹ LD Least destructive sampling.

² Number in parenthesis represents %.

Table 2. Hurricane damaged live trees with termites in City Park, New Orleans, Louisiana.

TREE	<i>C. formosanus</i>	Other
Palm, Sp. unknown, Palmae	6	1
Live Oak, <i>Quercus virginiana</i> Mill, Fagaceae	1	0
White Oak, <i>Quercus alba</i> L., Fagaceae	2	1
Southern Red Oak, <i>Quercus falcata</i> Michx., Fagaceae	2	0
Southern Hackberry, <i>Celtis laevigata</i> Willd., Ulmaceae	5	3
Elm, <i>Ulmus americana</i> L., Ulmaceae	2	0
Pine, <i>Pinus</i> sp., Pinaceae	2	0
Willow Oak, <i>Quercus phellos</i> L., Fagaceae	0	1
Baldcypress, <i>Taxodium distichum</i> Rich, Pinaceae	1	0
Cedar, <i>Juniperus</i> sp., Pinaceae	0	1
TOTAL	21	7

where 4% of all living trees surveyed had *Reticulitermes* shelter tubes present. *C. formosanus* shelter tubes which were observed did not lead directly to dead, decaying branch stubs as reported by Esenther *et al.* (1961) for *R. flavipes*. Live Oaks were infested 12.3 % of the time with Formosan termites (Table 1). Half of the 6 infested Live Oaks were identified as infested indirectly by staking alone. One Live Oak had visible termite mud on a limb scar, a condition which occurs throughout greater New Orleans (Osbrink, unpublished). Baldcypress had visible external Formosan termite tubing on the bark of two of the three infested trees. Some of these tubes extended over 4 meters up the tree's trunk. Infestation of the third Cypress was implicated from an infested stake at its base. One of the 8 cedars (12.5 %) had a stake infested with *C. formosanus* at its base. There was no indication of termite infestations of

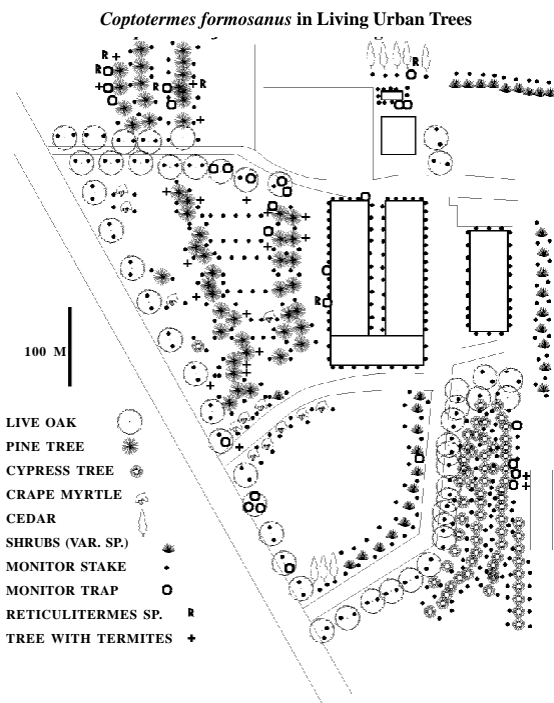


Figure 1. Diagrammatic representation of the Southern Regional Research Center, New Orleans, Louisiana, U.S.A. showing location of trees species, ground monitoring stakes, monitor traps, and buildings.

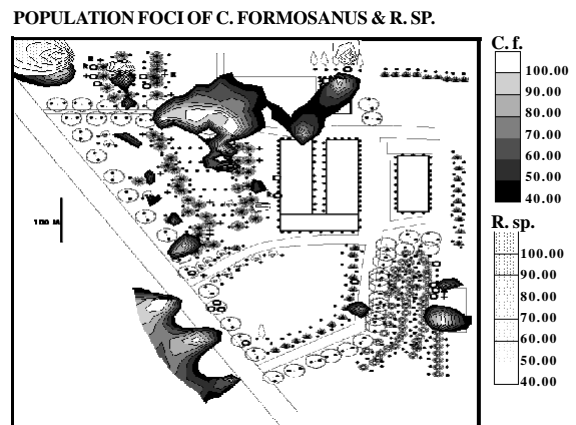


Figure 2. Foci of *Coptotermes formosanus* and *Reticulitermes* sp. at the Southern Regional Research Center, New Orleans, Louisiana.

crapemyrtle though this tree is commonly infested throughout greater New Orleans (Osbrink, unpublished). The occurrence of *C. formosanus* and *Reticulitermes* sp. in or on living trees has been observed before (Cooper and Grace, 1987; La Fage, 1985; Lai *et al.*, 1983).

The presence of termites in a tree base monitoring stake is not considered absolute proof of tree infestation. Subterranean foraging galleries originating from distant population foci are possible. However, termite populations in infested mature trees in New Orleans are generally high and the likely source of termites. None of the monitor stake transects across the lawn were infested.

Of the 500 monitoring stakes placed in the ground, there were 28 infested with termites (5.6%). *C. formosanus* infested 4.8% of the stakes compared with *Reticulitermes* sp. which infested 0.8%. *C. formosanus* was the dominant termite species when infested tree and monitoring stake infestations were combined, however, *Reticulitermes* sp. populations do coexist in the sample area (Fig 3.).



Figure 3. Wind damaged tree in City Park, New Orleans, Louisiana. *C. formosanus* feeding removed heart wood causing hollow and weakening of tree.

Note *C. formosanus* carton nest at apex of hollow in trunk.

Park tree survey

Of the 28 hurricane damaged trees which occurred in City Park, 21 (75%) were infested with *C. formosanus* (Table 2.). In almost every instance the failure occurred where there was structural damage by termites (Fig. 2). Some of the damaged trees tipped over due to termite destruction of the root system and the remainder were snapped or split at the trunk. Many of the trees were hollow, heart wood removed, with a *C. formosanus* carton nest plugging a portion of the hollow (Fig 2.). Carton nests occurred meters above ground level in the hollowed trunk, under the trunk attached to the root system, or both. Arboreal nesting may be a strategy to survive seasonal flooding.

The number of trees infested with Formosan termite is much higher than indicated by current established monitoring techniques. Following incidents of heavy wind, the number of living and externally healthy trees which break or fall due to structural damage caused by termite infestations, confirm this. Successful treatment of termite populations in trees will require the development of improved, non-destructive, monitoring techniques.

C. formosanus is clearly a threat to urban trees in greater New Orleans. Falling trees are a danger to life and property and mature shade trees have an aesthetic value that is difficult to quantify. Live Oaks in New Orleans, some of which are over 200 years old, have irreplaceable historical value. Of concern also is the impact this termite could have on the forest industry.

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