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## CURRENT DISTRIBUTION OF THE FORMOSAN SUBTERRANEAN TERMITE AND OTHER TERMITE SPECIES (ISOPTERA: RHINOTERMITIDAE, KALOTERMITIDAE) IN LOUISIANA

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### ABSTRACT

A statewide survey in Louisiana on the current distribution of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, and other termite species was conducted with 91 pest control companies, city and state agencies, and the New Orleans Mosquito and Termite Control Board from January 1999 to August 2002. A total of 812 samples were used in the survey constituting all eight known termite species from Louisiana. The subterranean termite species identified were *Reticulitermes flavipes* (Kollar), *R. virginicus* (Banks), *R. hageni* Banks, and *C. formosanus*. The drywood termite species identified were *Incisitermes snyderi* (Light), *I. minor* (Hagen), *Cryptotermes brevis* (Walker), and *Kaloterмес approximatus* (Snyder). *Incisitermes minor* was also collected in Mississippi and is a new record in that state. The collective data on the flight season of each species was also recorded.

**Key Words:** *Coptotermes formosanus*, Rhinotermitidae, Kalotermitidae

### RESUMEN

Un reconocimiento de la distribución actual de la termita subterránea formosana, *Coptotermes formosanus* Shiraki y de otras especies de termitas fue llevado a cabo en Louisiana, EE.UU. con la colaboración de 91 compañías de control de plagas, las agencias estatales y municipales, y el Buró de Control de Mosquitos y Termitas de Nueva Orleans desde enero de 1999 hasta agosto de 2002. Un total de 812 muestras fueron usadas en el reconocimiento constituyendo las ocho especies de termitas conocidas de Louisiana. Las termitas subterráneas identificadas fueron *Reticulitermes flavipes* (Kollar), *R. virginicus* (Banks), *R. hageni* Banks, y *C. formosanus*. Las termitas de madera seca identificadas fueron *Incisitermes snyderi* (Light), *I. minor* (Hagen), *Cryptotermes brevis* (Walker), y *Kaloterмес approximatus* (Snyder). *Incisitermes minor* fue también colectada en Mississippi y es un nuevo registro en aquel estado. Los datos colectivos sobre la temporada de vuelos para cada especie también fueron registrados.

Translation provided by author.

The Formosan subterranean termite (FST), *Coptotermes formosanus* Shiraki (Isoptera: Rhinotermitidae), was first identified in Lake Charles, Louisiana, in 1966 and in New Orleans in 1967 (Spink 1967). It is widely believed that this exotic species was introduced into the continental U.S. after infested material was brought over from Asia after World War II (Su and Tamashiro 1987). For the past 30 years, FST infestations have been found in other cities and various small communities throughout Louisiana. The main source of introduction to these other areas is caused, in part, by the transportation of infested building materials, utility poles, and railroad ties used in landscaping (La Fage 1987). Then, natural spread has occurred via alate dispersal flights.

The last statewide survey involving the pest control community for all termite species was conducted around the time of the first confirmed re-

port of the FST (Weesner 1965). During the last survey, species and flight data were only recorded from Rapides Parish, which includes the city of Alexandria. *Reticulitermes flavipes* (Kollar), *R. virginicus* (Banks), *R. hageni* Banks (Isoptera: Rhinotermitidae), and *Incisitermes snyderi* (Light) (Isoptera: Kalotermitidae) were collected from this region of the state. Previously, Light (1934) and Snyder (1954) listed five species in Louisiana. They included *R. flavipes*, *R. virginicus* (Isoptera: Rhinotermitidae), *Kaloterмес (=Incisitermes) snyderi*, *Kaloterмес approximatus* (Snyder), and *Cryptotermes brevis* (Walker) (Isoptera: Kalotermitidae). Recently, Messenger et al. (2000) discovered established populations of *Incisitermes minor* (Hagen) (Isoptera: Kalotermitidae) in New Orleans.

Since the last national survey in 1965, individual statewide termite surveys have been con-

ducted in Georgia (Scheffrahn et al. 2001), Florida (Scheffrahn et al. 1988), Texas (Howell et al. 1987), and South Carolina (Hathorne et al. 2000). These surveys significantly contributed to our understanding of the current distribution of the economically important FST.

Because there have been many unconfirmed reports of the FST throughout the state, the main objective of this survey was to identify and confirm the current distribution of the FST in Louisiana with the help of the pest control industry, the Louisiana Department of Agriculture and Forestry, and mosquito control districts. In addition, the New Orleans Mosquito and Termite Control Board concurrently conducted a separate statewide survey for all subterranean and drywood termite species.

MATERIALS AND METHODS

Pest Management Professional (PMP) Survey

Beginning in January 1999, letters asking for participation in the survey were mailed to 589 PMPs and mosquito control districts throughout Louisiana, including a few pest control companies operating near the state line in Mississippi and Texas. Termite collecting packets were then prepared and sent to each company who returned the postcard with a response of willingness to participate. Each packet included individually numbered collection vials (13 ml polypropylene Snap-Seal®, Corning Brand) containing 85% ethanol, corresponding vial data sheets, return padded envelopes, and a hand-held aspirator. Each participant was encouraged to collect termite alates and soldiers during routine inspections and treatments of residential and commercial structures. They were also encouraged to include any relevant information from each collection on the data sheet, which included date and location of collection, flight date (if applicable), and any additional comments and requests for more collection vials.

N. O. Mosquito and Termite Control Board (NOMTCB) Survey

The senior author and other coworkers conducted a deliberate survey throughout Louisiana from 1999 to 2001. Termites were collected from live and dead trees, state parks, railroad ties, highway rest areas, private and public buildings, and any other type of wood found along highways and parish roads. We also traveled to addresses throughout the state to verify FST infestations and conduct further surveys in the surrounding areas. In addition, samples and FST locations were received from J. McPherson, Program Coordinator, Pesticide and Environmental Programs, Louisiana Department of Agriculture and Forestry, Baton Rouge, LA.

For both surveys, termite alates and soldiers were identified to species using termite keys de-

veloped by Banks & Snyder (1920), Miller (1949), Snyder (1954), Weesner (1965), Scheffrahn & Su (1994), and Hostettler et al. (1995). Samples containing only workers (*Reticulitermes* spp.) or pseudergates were identified to the family and/or genus level. Data from both surveys was entered into a computer database (FileMaker® Pro 3.0, Claris® Corporation). Longitude and latitude coordinates from the NOMTCB survey were recorded at each sample site using a Garmin GPS model 12 CX (Garmin International, Inc., Olathe, KS) hand-held global positioning receiver. Locations of each collection were plotted using ArcView GIS version 3.1 software (Environmental Systems Research Institute, Inc., Redlands, CA).

RESULTS

PMP Survey

Out of the original 589 survey letter mailings, 91 (15%) companies and individuals agreed to participate by collecting any type of termite they encountered during routine inspections and treatments of urban structures and trees. There was no response from 453 (77%) companies and 45 (8%) responded, but declined to participate. The majority of the companies who declined indicated that they do not conduct termite treatments.

As a result, 52 of the 91 participants returned collection vials for a total of 426 samples. All eight known termite species were collected (Table 1). The majority of these samples were collected from separate addresses. *Reticulitermes flavipes* was the most commonly collected species throughout the state (Table 1). The FST was the second most commonly collected species; however, the majority of the FST samples were collected from the New Orleans and Lake Charles areas (Table 1).

Each participant also included an exact or approximate date of dispersal flight whenever they collected alates. For the subterranean species,

TABLE 1. TOTAL NUMBER OF IDENTIFIED TERMITE SPECIES FROM VIALS COLLECTED DURING THE PMP SURVEY.

| Termite species                  | Number of vials |
|----------------------------------|-----------------|
| <i>Reticulitermes flavipes</i>   | 204             |
| <i>Coptotermes formosanus</i>    | 118             |
| <i>Reticulitermes virginicus</i> | 40              |
| <i>Incisitermes snyderi</i>      | 9               |
| <i>Cryptotermes brevis</i>       | 7               |
| <i>Incisitermes minor</i>        | 3               |
| <i>Kaloterms approximatus</i>    | 3               |
| <i>Reticulitermes hageni</i>     | 3               |
| Workers/pseudergates only        | 39              |
| TOTAL                            | 426             |

TABLE 2. TOTAL NUMBER OF TERMITE SPECIES AND SAMPLES COLLECTED DURING THE NOMTCB SURVEY.

| Termite species                  | Number of collections |
|----------------------------------|-----------------------|
| <i>Reticulitermes flavipes</i>   | 177                   |
| <i>Reticulitermes hageni</i>     | 65                    |
| <i>Reticulitermes virginicus</i> | 64                    |
| <i>Coptotermes formosanus</i>    | 40                    |
| <i>Incisitermes snyderi</i>      | 21                    |
| <i>Incisitermes minor</i>        | 9                     |
| <i>Cryptotermes brevis</i>       | 8                     |
| <i>Kaloterms approximatus</i>    | 2                     |
| TOTAL                            | 386                   |

*R. flavipes* alates were recovered from Jan. 17 to April 19, *R. virginicus* alates from March 1 to May 17, *R. hageni* on Dec. 17, 2001 (single record), and the FST from April 12 to May 9. For the kaloter-

mid species, *I. snyderi* alates were recovered from May 10 to July 22, *C. brevis* from May 9 to July 25, and *K. approximatus* from Oct. 10 to Nov. 1. Alate samples of *I. minor* were collected from Sept. 10 to Dec. 4 in Rayne, Cameron, and Le Moyeu, LA; however, monitoring of dispersal flights by the senior author in the New Orleans metro area occurred each year from late April to early June.

#### NOMTCB Survey

*Reticulitermes flavipes* was by far the most commonly collected termite species throughout Louisiana (Table 2). *Reticulitermes hageni* and *R. virginicus* were the two second most commonly collected species (Table 2). The number of FST collections only represents a few selected, confirmed sites throughout the state and does not include any samples taken from New Orleans. The distribution of FST infestations in Louisiana has significantly increased since 1966 (Table 3).

TABLE 3. LOCATION OF *COPTOTERMES FORMOSANUS* INFESTATIONS IN LOUISIANA, 1966-2001.

| Year  | Parish           | City   |
|-------|------------------|--|
| 1966* | Orleans          | New Orleans, Algiers   |
|       | Calcasieu        | Lake Charles   |
| 1968* | Orleans          | New Orleans, Algiers   |
|       | Calcasieu        | Lake Charles   |
|       | Jefferson        | Grand Isle   |
|       | La Fourche       | Raceland   |
| 1986* | Orleans          | New Orleans, Algiers   |
|       | Calcasieu        | Lake Charles, Westlake   |
|       | Jefferson        | Metairie, Gretna, Grand Isle                                     |
|       | La Fourche       | Raceland   |
|       | St. Tammany      | Slidell, Covington   |
|       | Lafayette        | Lafayette  |
|       | East Baton Rouge | Baton Rouge  |
| 2001  | Orleans          | New Orleans, Algiers   |
|       | Calcasieu        | Lake Charles, Westlake, Moss Bluff, Sulphur                      |
|       | Jefferson        | Metairie, Gretna, Grand Isle, Kenner, Harahan, Westwego, Marrero |
|       | La Fourche       | Raceland, Thibodaux, Larose, Cut Off, Galliano                   |
|       | St. Tammany      | Slidell, Covington   |
|       | Lafayette        | Lafayette  |
|       | East Baton Rouge | Baton Rouge  |
|       | Ascension        | Prairieville   |
|       | St. Charles      | Norco  |
|       | Assumption       | Pierre Part  |
|       | Terrebonne       | Houma, Montegut  |
|       | St. Bernard      | Chalmette  |
|       | Plaquemines      | Belle Chase  |
|       | Iberia           | New Iberia   |
|       | Vermilion        | Abbeville  |
|       | St. Landry       | Sunset   |
| 2002  | Sabine           | Noble  |
|       | Ouachita         | Monroe, West Monroe  |
|       | Acadia           | Rayne  |
|       | St. Mary         | Amelia   |

\*La Fage 1987.

In New Orleans, FST flight activity was monitored by the senior author using glue traps (TRAPPER® LTD, Bell Laboratories, Inc., Madison, WI) installed under lights near the French Quarter. Nightly observations and the number of FST alates recovered from glue traps reveal peak flight activity usually occurs from mid-May to early June, with some activity through mid-July (Table 4).

The majority of the *I. minor* and *C. brevis* samples were received from J. McPherson and local residents of New Orleans.

Location data from both surveys for the FST (Fig. 1), *Reticulitermes* species (Fig. 2), and kalotermitid species (Fig. 3) are presented on ArcView-generated maps.

DISCUSSION

The distribution of the FST in Louisiana has increased dramatically since the first confirmed reports in the mid-60s. However, many of these newer, confirmed infestations have remained relatively localized, and state officials have begun to target these areas for immediate treatment. Most of these localized introductions have occurred around structures, such as churches, or parks and campsites where FST-infested railroad ties were used as landscaping and/or building material. Future monitoring and confirmation of any new FST reports throughout the state is the first step to controlling human-aided spread.

TABLE 4. COMBINED ALATE FLIGHT DATES FOR *COPTOTERMES FORMOSANUS* IN NEW ORLEANS, LOUISIANA, FROM 1998 TO 2001.

| Date             | Year    | Date             | Year    | Date     | Year |         |
|------------------|---------|------------------|---------|----------|------|---------|
| May 4            | 1998    | 2nd week of Jan. | 2000    | April 8  | 2001 |         |
| May 11           |         | 2nd week of Feb. |         | April 13 |      |         |
| May 16           |         | March 26         |         | April 14 |      |         |
| May 18*          |         | April 18         |         | April 15 |      |         |
| May 19           |         | April 25         |         | April 16 |      |         |
| May 22           |         | April 29         |         | April 24 |      |         |
| May 26           |         | May 3            |         | May 1    |      |         |
| May 29*          |         | May 4            |         | May 4    |      |         |
| June 6           |         | May 5            |         | May 5    |      |         |
| June 8           |         | May 8            |         | May 7    |      |         |
| June 18          |         | May 10           |         | May 9    |      |         |
| June 21          |         | May 14           |         | May 12   |      |         |
| June 23          |         | May 15 *         |         | May 13   |      |         |
| June 28          |         | May 21           |         | May 14   |      |         |
| 2nd week of Feb. |         | 1999             |         | May 22   |      | May 15* |
| April 6          |         |                  |         | May 26   |      | May 17  |
| April 26         |         |                  |         | May 29   |      | May 20  |
| April 27         |         |                  |         | June 4   |      | May 21  |
| April 28         | June 15 |                  | May 22  |          |      |         |
| May 6            | June 16 |                  | May 23  |          |      |         |
| May 7            | June 17 |                  | May 24  |          |      |         |
| May 12*          |         |                  | May 25  |          |      |         |
| May 14           |         |                  | May 26  |          |      |         |
| May 17           |         |                  | May 31  |          |      |         |
| May 18           |         |                  | June 1* |          |      |         |
| May 19           |         |                  | June 4  |          |      |         |
| May 25           |         |                  | June 7  |          |      |         |
| May 27           |         |                  | June 11 |          |      |         |
| May 29*          |         |                  | June 14 |          |      |         |
| June 6           |         |                  | June 18 |          |      |         |
| June 9           |         |                  | June 21 |          |      |         |
| June 10          |         |                  | June 24 |          |      |         |
| June 22          |         |                  | June 28 |          |      |         |
| June 27          |         |                  |         |          |      |         |
| 1st week of July |         |                  |         |          |      |         |
| July 7           |         |                  |         |          |      |         |
| July 13          |         |                  |         |          |      |         |
| 3rd week of July |         |                  |         |          |      |         |

\*Largest dispersal flight (s) each year.

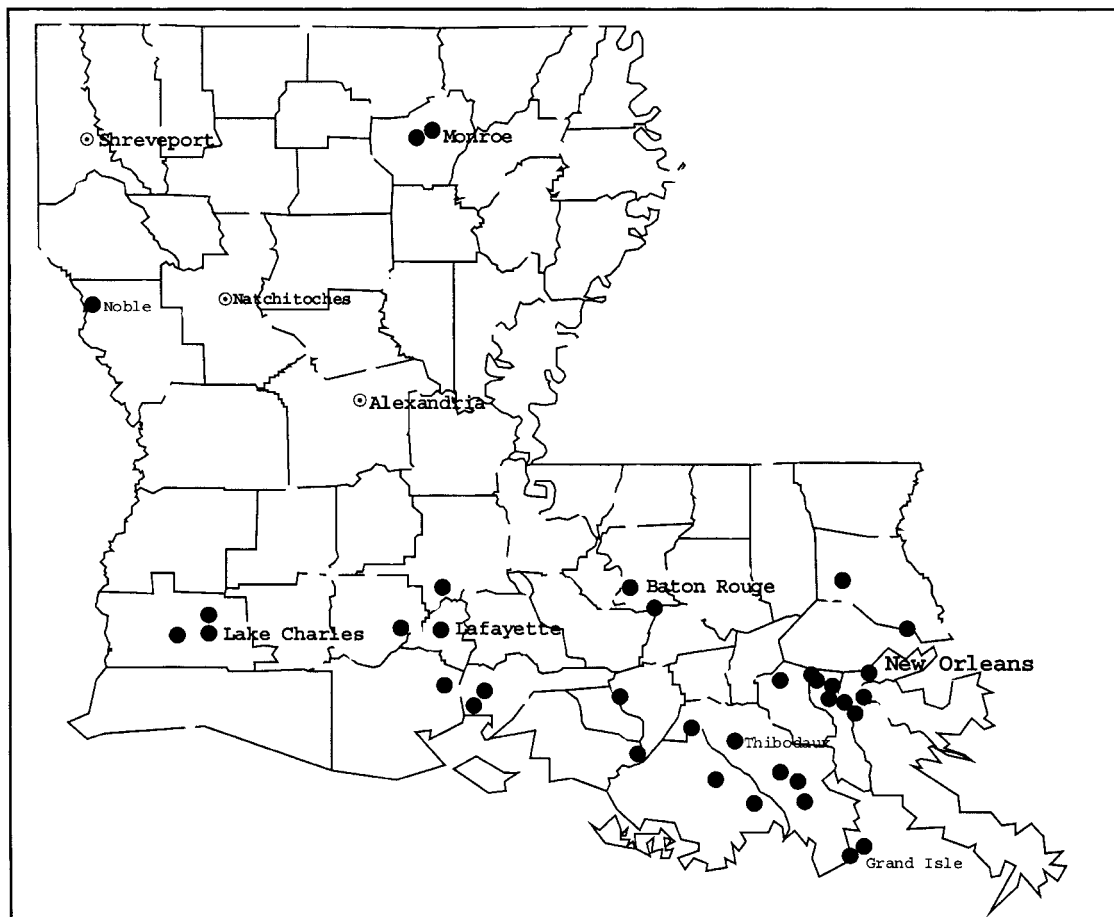


Fig. 1. Current distribution of *Coptotermes formosanus* in Louisiana.

Outside the New Orleans and Lake Charles areas, *R. flavipes* and *R. virginicus* are the two most economically important subterranean termite species, with *R. flavipes* being the most common. The spatial distribution of all three *Reticulitermes* species is consistent statewide; however, *R. flavipes* seems to be more common in the extreme southern portions of the state. For example, samples of *R. flavipes* were collected from house pilings directly in the sand at Holly Beach on the Gulf of Mexico and from fishing camps around the Mississippi River delta basin.

During the PMP survey, *R. hageni* was rarely encountered in structures. In addition, *K. approximatus* was only collected from dead portions of trees and from alates flying into the vehicles of participants on two separate occasions. For both species, this confirms their general status as very limited structural pests (Weesner 1970, Scheffrahn et al. 1988).

*Incisitermes snyderi* and *C. brevis* are the two most economically important kalotermitid species in Louisiana, with *I. snyderi* being the most com-

mon. *Cryptotermes brevis* is a non-endemic species and has only been recovered from structural lumber and furniture. *Incisitermes snyderi* is an endemic species commonly found in structural lumber and in dead portions of live trees throughout the southern half of the state.

The overall number of *I. minor* collections throughout the state was unexpected. Another interesting discovery was the number of public schools throughout the state with very active *I. minor* infestations, particularly in window framework. *Incisitermes minor* is endemic to CA, AZ, and Mexico, but has been introduced to many areas in the state, and in most cases, inside furniture. For example, a sample was taken from an infested pool table in Natchez, MS. In New Orleans, *I. minor* alates are usually collected from mid-April to mid-June during midday flights. However, alates were recovered after swarming from a window frame in an elementary school in Rayne, LA, during the second week of September 2001. In addition, *I. minor* alates were collected after swarming in a high school in Cameron, LA,

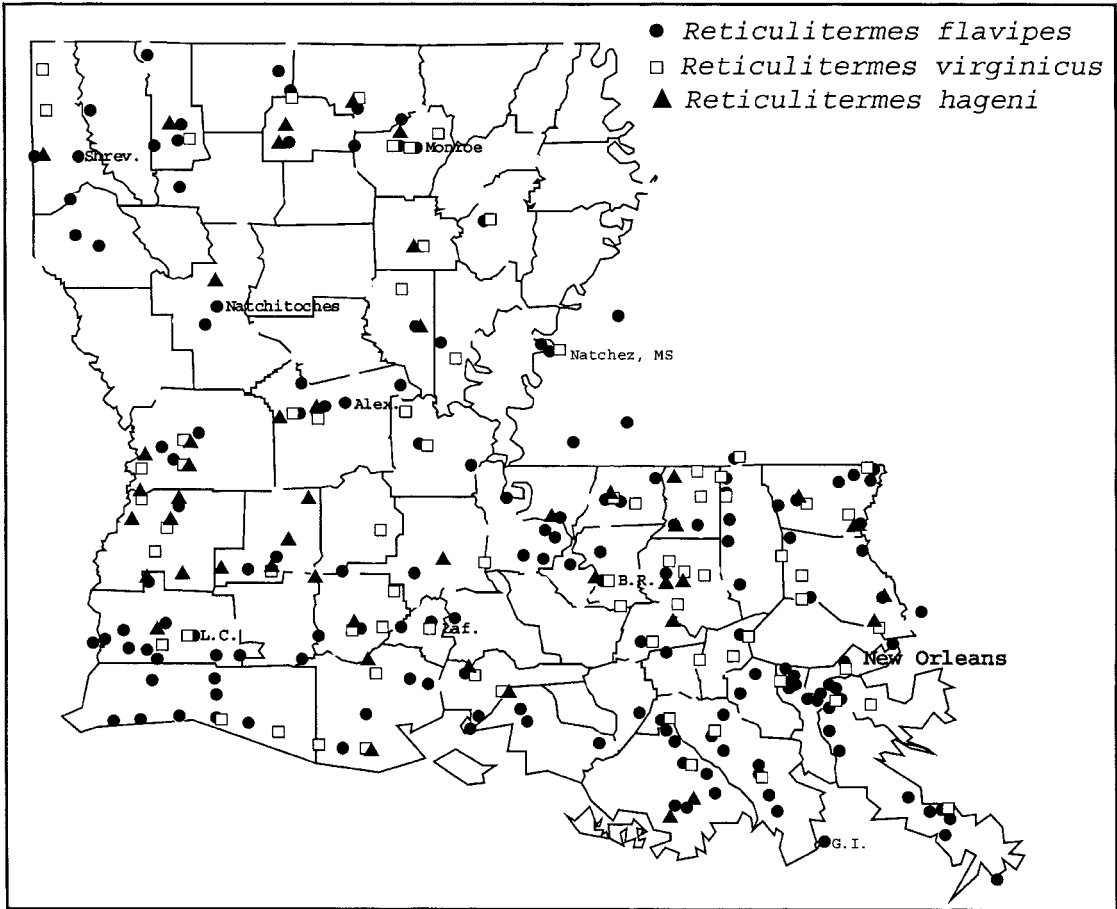


Fig. 2. Combined distribution data of *Reticulitermes* spp. in Louisiana from PMP and NOMTCB surveys.

in late September 2001. Historical records reveal the flight season of *I. minor* usually occurs from July to December, and as early as May in the laboratory (Harvey 1934). In addition, *I. minor* flight records in California (Snyder 1954), Florida (Scheffrahn et al. 1988), and Georgia (Scheffrahn et al. 2001) revealed swarming usually occurs from September to November. An alarming discovery revealed *I. minor* alates swarming in a lumberyard near Le Moyeu, LA, in December 2001. This could lead to future introductions throughout the state.

In addition to the overall survey, a pictorial termite identification key was developed in 2001 to help PMPs, state officials, and termite researchers identify the FST and other economically important subterranean and drywood termite species currently present in Louisiana (Messenger 2002).

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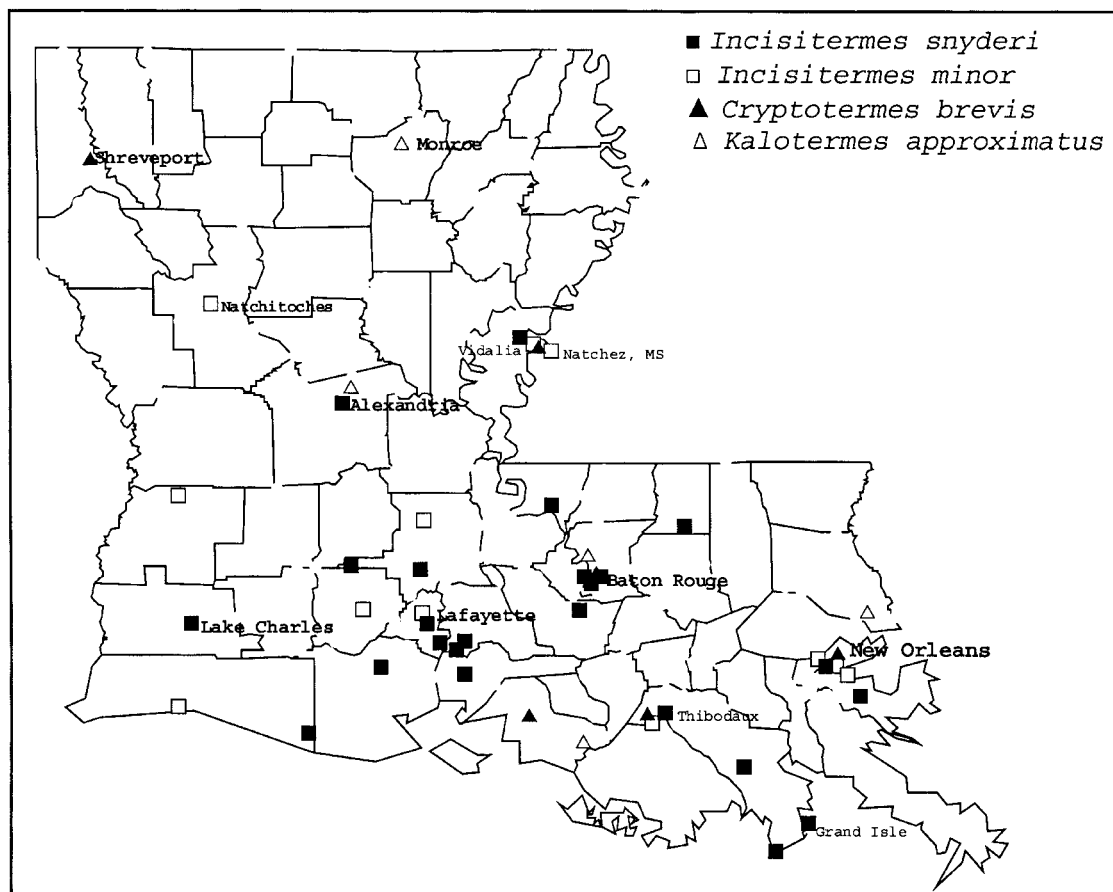


Fig. 3. Combined distribution data of kaloterimid species in Louisiana from PMP and NOMTCB surveys.

Richard L. Robards Termite Services; Hookfin Pest Control Co., Inc.; Sugarland Exterminating Co., Inc.; Couhig Southern Environmental; Terminix—Slidell; Anti-Pest & Veitch, Inc.; Kevin's Pest Control, Inc.; Slug-A-Bug Exterminating Co.; E & G Pest Control, Inc.; Jerome Williams Pest Control Co.; Woods Pest Control; Sears Termite & Pest Control Inc.; Billiot Industries, Inc.; Vexcon Inc.; Stetler Pest Control; A Plus Exterminators, Inc.; Brent's Pest Control Services; Guardian Pest Control; Arceneaux Consulting; Calcasieu Parish Mosquito Control; East Baton Rouge Mosquito and Rodent Control; Mosquito Control, Inc.; St. Bernard Parish Mosquito Control; Louisiana Department of Agriculture and Forestry; and USDA-ARS SRRC. Partial funding for this project was provided by USDA-ARS under the grant agreement No. 58-6435-8-108. This article is Florida Agricultural Experiment Station Journal Series No. R-08828.

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