

A Method to Access, Trap, and Monitor Field Populations of the Formosan Subterranean Termite (Isoptera: Rhinotermitidae) in the Urban Environment

by

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ABSTRACT

A method is described which utilizes a wooden block placed in the ground to bait the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, in an urban environment. More than 10,000 termites have been collected from a single trap. Traps also provide an access to monitor the field activity of foraging populations of this species in infested urban sites.

INTRODUCTION

Species of Rhinotermitidae cause substantial damage to structures and wood products. Annual losses and control costs for subterranean termites (*Reticulitermes* spp.) in nine states of the southeastern United States were estimated at \$435 million in 1983 (Hamer 1985). The increasing sightings of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, in seven southeastern states (Su & Scheffrahn 1986) implicates this species as an emerging pest in this area mirroring its past destructive history in Hawaii since the turn of the century.

Despite the economic importance of subterranean species such as *C. formosanus*, little is known about their field ecology due to their cryptic nature. Field studies of subterranean termites typically use a cellulosic bait placed on the ground. Toilet roles were used to bait the desert subterranean termites, *Gnathamitermes perplexus* (Banks) and *Heterotermes aureus* (Snyder) (La Fage et al. 1973), and Australian subterranean termites, *H. ferox* (Froggatt), *C. acinaciformis* (Froggatt), and *C. frenchi* Hill (French & Robinson 1981). This method was later modified by substituting corrugated fiberboard to trap the eastern subterranean termite, *R. flavipes* (Kollar) (Esenther 1980), the mound-building species, *C. lacteus* (Froggatt) (French & Robinson 1985), and to extract termites from wood in the

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laboratory (La Fage et al. 1983).

Paper products such as toilet roles or fiberboard, however, disintegrate rapidly under warm and humid conditions, thus are not suitable for field baiting *C. formosanus*. Moreover, a voracious species such as *C. formosanus* quickly consumes these paper products, making long-term field studies labor-intensive. In this context, the wooden trap developed by Tamashiro et al. (1973) for collecting and monitoring field activities of *C. formosanus* appears suitable for field studies of this termite.

The trapping system of Tamashiro et al. (1973) is composed of a bundle of wood placed on the ground covered by a steel can (27 cm diam. by 36 cm high). A single trap was reported to contain up to 35,000 termites. This method also provided easy access to the subterranean colony, making possible studies of population dynamics using a mark-recapture method (Lai 1977), foraging behavior (Su et al. 1984), as well as a port of entry for introduction of control agents such as microbes (Lai 1977) or a slow-acting termiticide (Su et al. 1982). The short-coming of this technique is the high visibility of the trap. When placed in a densely populated urban environment, vandalism or disturbance of these traps is inevitable.

C. formosanus is typically found in populated urban areas such as Honolulu, HI; New Orleans, LA; Charleston, SC; and Hallandale, FL (Su & Scheffrahn 1986). We developed an underground version of the baiting system described by Tamashiro et al. (1973), to study this termite and other subterranean species in such an environment.

MATERIALS AND METHODS

Wooden stakes (*Picea* spp.) of 2.5 by 4.0 by 28 cm (Fig. 1a) were driven 25 cm into soil of planters and lawns adjacent to side-walks, parking lots, and walls of buildings found infested by *C. formosanus*. Some infested buildings reported by Thompson (1985) were also included in this study. Stakes were planted at ca. 5 m intervals and examined monthly. When found infested by termites, soil surrounding a stake was removed and a collar (17 cm o.d. by 15 cm high by 0.8 cm thick) made from polyvinyl-chloride (PVC) pipe (Fig. 1c) was placed in the hole to form a ca. 3.4-liter underground cavity. A hollow wooden (*Picea* spp.) block (Fig. 1b, 12 by 7 by 10 cm by 1 cm thick) was slipped over the stake and the latter was then gently tapped deeper into the soil so the top of the stake stays below the edge of the pipe. A plastic food-container cover (Eagle Products, NY, Fig. 1d, 16.5 cm diam. by 0.5 mm thick) was placed over the exposed end of the PVC pipe and covered with soil. A temperature-monitoring hole (ca. 1.3 cm diam.) was pre-drilled in each plastic cover and a piece of polyethylene disk (ca. 2 cm diam. by 1 mm thick) reinforced by duct tape was glued over the hole. A cross incision was made into the polyethylene disk to provide entry for a thermocouple probe attached to a digital thermometer (Model

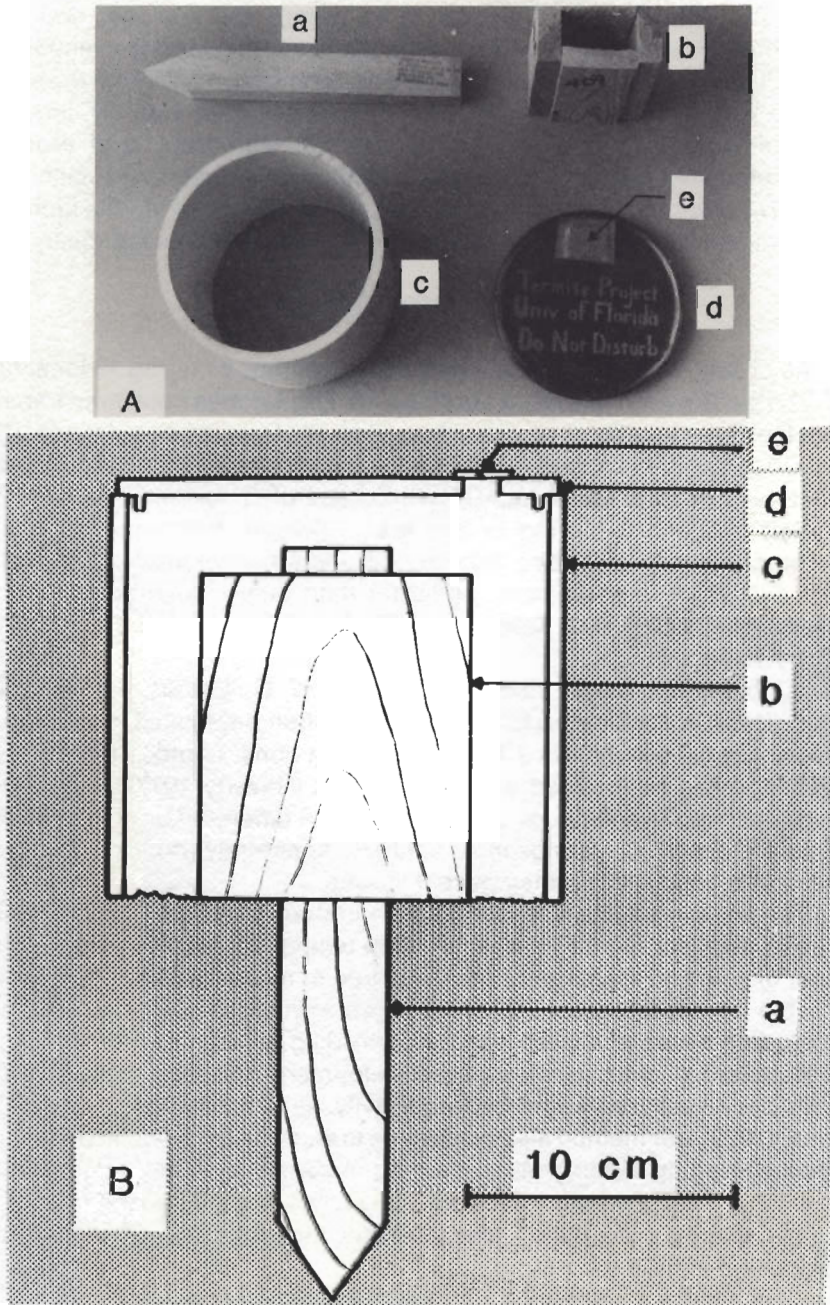


Fig. 1. A: Basic components of a baiting system used for trapping *C. formosanus*. B: Trap placed in the ground. Shaded area indicates soil. a: monitoring stake, b: trap box, c: PVC pipe collar, d: trap lid, e: temperature-monitoring hole covered by a piece of polyethylene disk reinforced by duct tape.

8110-25, Cole-Parmer, Chicago, Ill) to record the air, soil, and trap temperature. When not in use, the slit is sealed by the duct tape reinforced polyethylene disk. When left undisturbed, termites burrow from the stake to the wooden block. Termite activity was monitored monthly. Infested blocks were collected and brought to the laboratory, and termites separated from debris by the bridging method described by Tamashiro et al. (1973). Number of each caste was recorded, and mean termite biomass determined by weighing five groups of 10 individuals of each caste.

RESULTS AND DISCUSSION

As of July 1986, there were a total 83 active traps covering 15 locations in coastal Broward and Dade counties, FL. The catches from three traps at each of three locations, representing separate foraging populations of *C. formosanus*, are summarized in Table 1. Yields ranged from 919 to 11,309 termites per trap. Mean individual biomass of *C. formosanus* workers varied between 3-5.4 mg in this area. Workers from location B are generally large (average ca. 5.0 mg), with some individuals weighing up to 6.0 mg, which are substantially larger than those commonly found in Hawaii (ca. 3.2 mg, Su & Tamashiro 1986) or Louisiana (ca. 2.9 mg, Su & La Fage 1984).

Although the mean soldier proportion of *C. formosanus* foraging population is considered ca. 10-15%, and often duplicated in laboratory experimental groups (Su & La Fage 1984), a considerable intra-specific variation has been noted among colonies (Haverty 1977). Our results indicate that such variation exists even within different foraging sites of a single colony. *C. formosanus* soldiers apparently do not distribute homogeneously within their gallery system.

The trapping system is well hidden underground and vandalism by urban dwellers has been minimal. Trap temperatures are slightly above that of soil, and therefore is relatively free of air temperature fluctuation (Table 1). Most castes have been represented in our trap catches including alates and alate nymphs, providing an opportunity to monitor the seasonal changes in caste development and proportions, mean biomass of each caste, and feeding activity. As with the traps of Tamashiro et al. (1973), our method also enables us to study the population dynamics, define foraging territory using marking materials such as Sudan Red 7B (Lai et al. 1983, Su et al. 1983), and possibly to investigate the inter- and intra-specific competition among subterranean termite colonies in the field.

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Table 1. Trap catch of the Formosan subterranean termite from Hallandale, FL.

Loc. Trap No.	Mon. Collected	Worker		Soldier		Alate Nymph		Alate		Soldier Proportion (%)		Temperature (°C)		
		No.	Wt*	No.	Wt*	No.	Wt*	No.	Wt*	No.	Wt*	Air	Soil	
A	T1	Jan.	1,667	3.3	91	3.7	529	9.7	0	-	4.0	15.2	13.9	15.7
	T2	Jan.	1,284	3.0	131	3.7	841	9.6	0	-	5.8	15.2	15.4	16.0
	T3	Jan.	2,098	3.6	221	3.6	113	9.6	0	-	9.1	15.2	15.2	15.8
B	T1	Sep.	6,478	4.5	201	4.5	0	-	0	-	3.0	32.5	29.4	29.4
	T2	Sep.	1,030	4.5	200	4.4	0	-	0	-	16.3	32.3	28.0	28.8
	T3	Dec.	919	5.4	38	4.5	0	-	0	-	4.0	21.8	19.2	19.4
C	T1	May	11,309	4.2	246	4.4	0	-	11	9.0	2.1	26.9	24.1	24.6
	T2	Jul.	1,545	4.0	242	4.0	0	-	0	-	13.5	29.9	26.5	26.6
	T3	Jul.	2,490	3.8	184	4.0	5	10.0	0	-	6.9	28.4	27.3	27.6

*mg/termite, derived as the 1/10 of the mean wet weight of five groups of 10 termites each.

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