

Desert Subterranean Termites: A Method for Studying Foraging Behavior^{1,2}

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Subterranean termites are among the most abundant but cryptic of animals, a factor making behavioral studies very difficult. Consequently little is known of their foraging behavior or general activity patterns. Previous studies have been restricted mainly to mound builders (Bouillon and Lekie 1964) or harvesters which forage openly on the soil surface (Bouillon 1970, Nel 1968). A few estimates of subterranean termite populations have been based on baiting with attractive materials or soil-core sampling (Sands 1972).

In this note we present a modification of the bait-sampling method which has provided data on the physical factors which regulate daily and seasonal foraging behavior of 2 subterranean species, in addition to information about spatial distribution of surface foraging groups. This study is part of a larger effort to be reported later, defining the role of termites in the detritus cycle of desert ecosystems.

Materials and Methods

The study site was situated 40 km S of Tucson, Ariz., on the Santa Rita Experimental Range, at 950 m elevation. The area is a shrub-invaded, desert grassland ecotone, characterized by scattered trees, shrubs, and cacti. The method devised to observe foraging behavior involved clearing the dead wood from an area 40×40 m with subsequent division into 16 contiguous study plots, each 10×10 m. One hundred rolls of toilet paper,⁵ wrapped with tape to prevent raveling, were placed on each of the plots on grids at 1-m intervals (Fig. 1). The paper served as a food source which attracted the termites to the surface where their foraging behavior could be observed on a continuing basis. One hundred fir blocks (8.5×10.0×4.0 cm) were placed on each of 2 nearby 10×10-m grids at the beginning of the experiment to compare attractiveness with toilet paper. The blocks were checked occasionally for presence of foragers and evidence of past activity. Observations on the toilet paper plots were made during one 24-h period each week from Oct. 15, 1971, to Oct. 12, 1972. A different

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⁵ Forest Park (unscented) 1-ply bathroom tissue, Graham Paper Co., St. Louis, Mo. 63102.

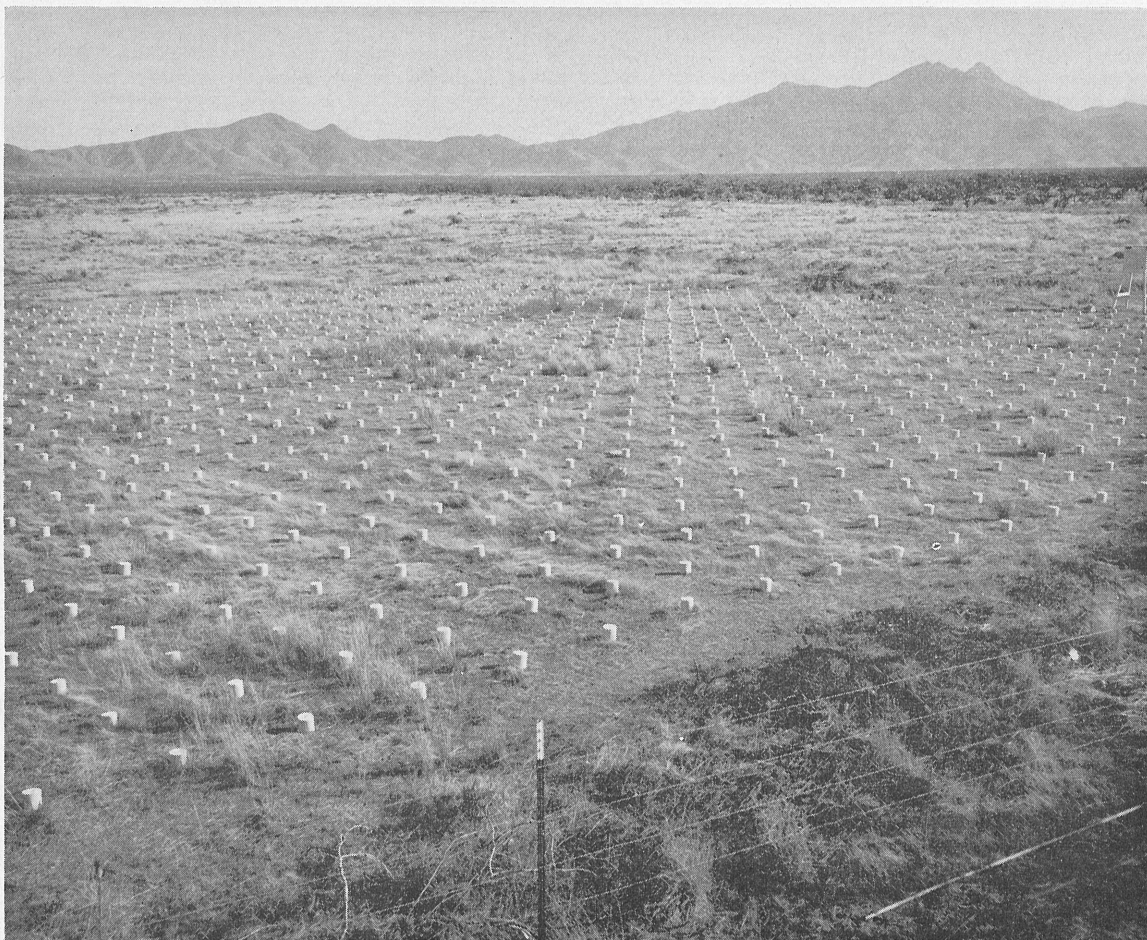


FIG. 1.—Area for studying termite foraging behavior situated on the Santa Rita Experimental Range, Pima Co. The lighter area in the foreground was cleared 18 months previously to remove large standing vegetation. Scattered dead wood was cleared from 1600 m² for setting out 16 contiguous study plots, each containing 100 toilet paper rolls spaced at 1-m intervals.

study plot (100 rolls) in a block of 12 was checked every 2 h. Thus no single roll was observed more than once a week. The 4 remaining plots were reserved for special studies at the end of one year involving soil movement to the surface by termite foragers.

Checking for termite foraging activity involved a quick examination of each roll, notation of the species and approximate number present or, if none were present, any evidence of past activity. In this manner, 100 rolls could be checked in about 30 min. Work of the 2 species which frequented the rolls regularly could be identified easily, since each built characteristic galleries and attacked the paper differently.

Prior to each check several physical factors were measured: temperatures at the soil surface, inside and under rolls, and at several subsurface levels to 125 cm. In addition, air temperature, relative humidity, temperature under a roll, and temperatures at depths of 3, 5, 10, and 15 cm were recorded continuously. Rainfall and soil-moisture measurements (at depths of 1–15, 15–30, 30–60, and 60–90 cm) were taken weekly.

Results and Discussion

The 2 most abundant subterranean termite species on the site, *Gnathamitermes perplexus* (Banks) and *Hetero-*

termes aureus (Snyder), worked the rolls regularly. *G. perplexus* foraged within a temperature range of 9.0–49.0°C and *H. aureus* between 7.6–47.0°C (extremes measured in the series from under a roll down to a soil depth of 15 cm).

These temperature extremes apparently control the foraging of each species. Thus both species worked the rolls continuously, day and night throughout the year, whenever soil temperatures permitted, in contrast to activity on the fir blocks, which was minimal or nonexistent even during periods of favorable temperatures. Whereas temperature governs the time which can be spent foraging, and to some extent foraging intensity (number of individuals at the surface), periodic rises in soil moisture following rain also increase foraging intensity. Regression analyses show that the lowest soil temperature (from under a roll to 15 cm) is correlated significantly with numbers of foragers at the surface.

At the end of 12 consecutive months of observation, distribution data indicate that the 2 species have very different foraging distributions (Fig. 2). Foragers of *G. perplexus* have worked nearly every roll (96%), removing small amounts of paper from the underside. *H. aureus* has attacked relatively few rolls (14%), but many of them have been heavily worked. The pattern of

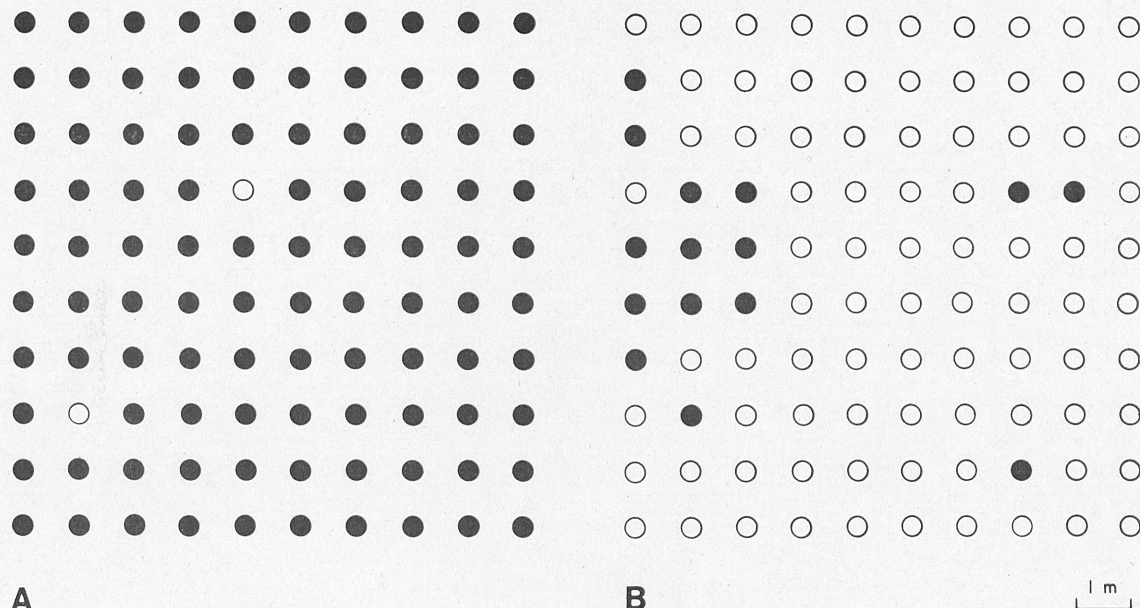


FIG. 2.—Foraging distributions of *G. perplexus* (A) and *H. aureus* (B) during a 12-month observation period on the same study plot of 100 toilet paper rolls placed at 1-m intervals. Each circle represents one roll of toilet paper; solid circles indicate the presence of termite foragers on at least one occasion during the study, while open circles represent unattacked rolls.

attack by *H. aureus* probably represents foraging territories of individual colonies, while no such pattern is evident for *G. perplexus*. Our experience indicates that termites locate and feed on toilet paper much more quickly than they do on wooden blocks, which are widely used for assessing effectiveness of chemicals against termite attack.

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