HELP, HELP ME RON-RON:
PREFERENTIAL USE OF CANOPY TREES BY TERMITES

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Abstract: Termites encounter a multitude of factors that may affect the distribution of their nests and trails in dry tropical forests. We measured the occurrence of active termite nests and trails on canopy trees versus understory trees and the preference of termites for certain canopy tree species in the forest of Palo Verde National Park. Termites showed a preference for canopy trees and, in particular, for the Ron-ron tree, *Astronium graveolens*. These findings suggest that termite colony success may be affected by nest height in the forest and tree species in which the colony occurs.

Key Words: Astronium graveolens, Nasutitermes

INTRODUCTION

Termite trails and nests in dry tropical forests are composed of a combination of woody debris and saliva combined with fecal glue, and are particularly susceptible to predation and disturbance. Nests are typically located externally on live trees, dead logs and other woody debris in the forest (Janzen 1983).

Nest site location is likely to have important consequences for colony growth and survivorship. Bansak et al. (1993) showed that occupied termite nests were higher in the forest than unoccupied nests, suggesting that nest height was important for termite success. Little seems to be known, however, about the relationship between the termite nest size, location, frequency of nest occurrence and forest composition in lowland tropical dry forest. There are numerous factors that may drive termite nest site selection, including predation avoidance, resource availability and climate. With regard to climate, understory trees might offer nests protection from rain in the wet season, while canopy trees might locate nests further from predators and closer to dead branches in the dry season. Our preliminary observations suggested a prevalence of termite nests in canopy trees, and in one species in particular, the Ron-ron, *Astronium graveolens* (family Anacardiaceae). To test the null hypothesis that termite nests are distributed non-randomly in the forest, we examined two predictions, one that nests are distributed non-randomly among tree species, and two, that they are distributed non-randomly among forest strata.

METHODS

This study was conducted on 8 - 9 January 2002 in Palo Verde National Park, Costa Rica. We surveyed secondary upland, dry forests adjacent to Sendero de Pizote, a trail about 0.5 km west of the OTS Biological Station.

To determine the location, frequency, abundance and possible tree species preference of termite nests, we selected four 50 m transects 100 m apart, each running north off the trail, each 40 m wide. All nests within these transects were counted. Once a nest was located, a small portion of the largest (often exclusive) tunnel was broken to qualitatively check for activity and to see whether the above nest was currently occupied. For each nest, we recorded nest diameter, the host tree species (when possible) and the tree circumference at 1.3 m above ground level.

To determine tree species abundance as well as termite trail location, we randomly selected five 25 by 25 m quadrats 25 m north

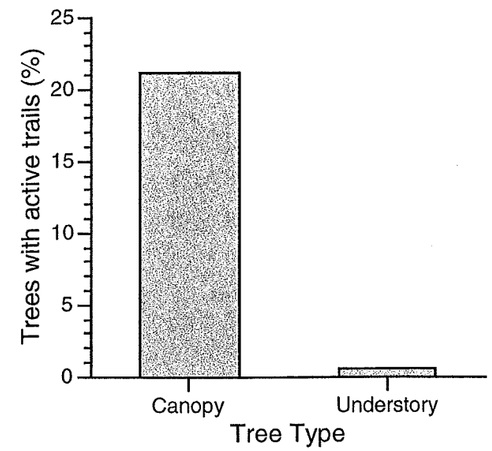

FIG. 1. Proportion of lowland dry forest trees in the understory and canopy with active termite nests (n = 174).

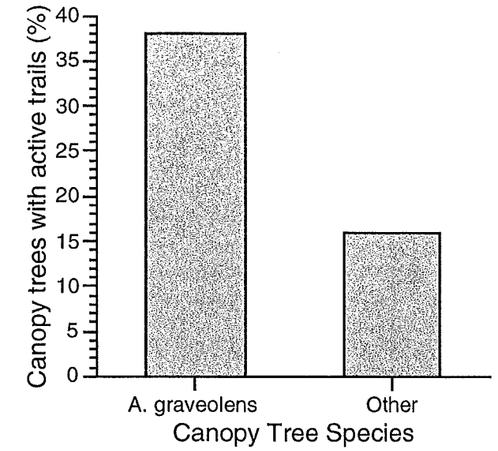

FIG. 2. Proportion of trees in the canopy with active termite trails in lowland dry forest separated by species (n = 57).

of Sendero de Pizote trail, the same area in which the transects were located. Within the quadrats, we sampled trees > 20 cm in circumference and recorded actual tree circumference. Termite nests were difficult to find in canopy trees, so we recorded the presence or absence of active termite trails on tree trunks to determine termite occupancy. Trees with trails that were inactive were grouped with trees lacking any termite trail at all. Each tree was classified as canopy if < 50% of its leaves were overshadowed by another tree and understory if > 50% of its leaves were overshadowed. Trees were identified as either *A.graveolens* or "other."

RESULTS

Sixteen termite nests were found in the 4 transects: 7 in *A.graveolens* trees and 9 in other tree species. Trees containing active termite trails averaged 118.2 ± 12.3 cm (±SE, n = 13) in circumference compared to 69.1 ± 8.7 cm (n = 160) trees without active trails. Trees containing nests had a significantly larger circumference than trees without nests (χ^2 = 83.98, df = 1, P = 0.001).

Of the 174 trees sampled in the quadrats, 33% were canopy trees and 67% were understory (Table 1). There were significantly more active termite trails on canopy trees (12 trails) than on understory trees (1 trail) (χ^2 = 29.1, df = 1, P < 0.001; Fig. 1, Table 2). Twenty-three percent of the 57 canopy trees sampled were *A. graveolens* and 65% percent of *A.graveolens* were canopy trees (Table 1). In addition, more canopy *A.graveolens* had active trails (38%) than did other canopy trees (16%), a marginally significant difference (χ^2 = 3.07, df = 1, P = 0.08; Fig. 2, Table 2).

DISCUSSION

Termites in the tropical dry forest at Palo Verde showed a preference for building trails in canopy trees, specifically *A.graveolens* (Fig. 1, 2). This preference suggests that there is an advantage for termites to build their trails and nests in the taller trees of the forest. There are a variety of costs and benefits associated with different nest heights that may affect the success of the colony. Advantages for high nests include safety from ground predators, including the anteater *Tamandua mexicana* (Janzen 1983) and proximity to dead branches. However, higher nests may be more susceptible to rain and wind damage, and they are further away from food resources on the for-

TABLE 1. Abundance of *Astronium graveolens* and other tree species in canopy and understory of four 40 x 50 m transect plots in tropical dry forest.

Tree species	Numbers		
	canopy	understory	total
A. graveolens	13 (65%)	7 (35%)	20 (11%)
Other	44 (28%)	110 (71%)	155 (89%)
Total	57 (33%)	117 (67%)	174 (100%)

TABLE 2. Number and frequency of trees by "species" and height strata containing active termite trails or no active trails in 25 x 25 m quadrats.

	Number of Trees		Total
	With no active trail	With active trail(s)	
Canopy (total)	12 (21%)	45 (79%)	57 (100%)
A. graveolens	5 (38%)	8 (62%)	13 (23%)
Other	7 (6%)	37 (84%)	44 (77%)
Understory (total)	1 (1%)	116 (99%)	117 (100%)

est floor and access to nearby trees. Furthermore, the relative importance of these factors could change from the dry season to the wet season. We noted that some termite nests located at or near ground level were unoccupied, which might be explained by termites shifting from high nests in the dry season to lower nests in the wetter parts of the year. Further studies of termite nests during the wet season could provide evidence for such seasonal migrations. Such changes in termite distribution, if they occur, have the potential to affect other aspects of the tropical dry forest. For example, the abundance of dead wood and distribution of termite predators could change depending on where termites locate their nests.

In addition to a preference for canopy trees, termites also seemed to show a preference for building trails on *A.graveolens* (Fig. 2). There are several possible explanations for this preference. Since *A.graveolens* make up a substantial portion (23%) of the canopy trees and since 65% of *A.graveolens* reach the canopy, termites looking for a high nest site would do well to utilize this species of tree. A selection bias of *A. graveolens* by the termites would increase the colony's probability of colonizing a canopy tree if high nest sites are more successful or survive longer. *A.graveolens* trees could also be especially susceptible to insect invasion or have extra dead tissue or other characteristics that benefit termites. Alternatively, the abundance of termite activity on *A.graveolens* trees could be a result of avoidance of other trees with insect defense systems or peeling bark and not a direct preference for *A.graveolens*. Further studies are needed to evaluate the causes of preferential nesting and activity of termites among tree species and strata in tropical dry forests.

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