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Effects of Tunnel Structures of Two Termite Species on Territorial Competition and Territory Size

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Abstract

The foraging territories of 2 subterranean termites, *Coptotermes formosanus* Shiraki and *Reticulitermes flavipes* (Kollar), were simulated using a model to explore how territorial intraspecific competition changes with 4 variables characterizing the formation of territory: the number of primary tunnels, N_0 ; the branching probability, P_{branch} ; the number of territories, N ; and the blocking probability, P_{block} . The blocking probability P_{block} quantitatively describes the probability that a tunnel will be terminated when another tunnel is encountered; higher P_{block} values indicate more likely termination. Higher tunnel-tunnel encounters led to denser tunnel networks. We defined a territory as a convex polygon containing a tunnel pattern and explored the effects of competition among termite colonies on territory size distribution at steady state attained after sufficient simulation time. At the beginning of the simulation, $N = 10, 20, \dots, 100$ initial territory seeds were randomly distributed within a square area. In our previous study, we introduced an interference coefficient γ to characterize territorial competition. Higher γ values imply higher limitations on network growth. We theoretically derived γ as a function of P_{block} and N . In this study, we considered the constants in γ as functions of N_0 and P_{branch} so as to quantitatively examine the effect of tunnel structure on

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