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The evolution of mound building in the Australian Coptotermes termites

Timothy Lee, Stephen Cameron, Theodore Evans, Simon Ho, Dieter Hochuli, Nathan Lo

The mounds of termites are the result of some of the most complex co-operative behaviour in the animal kingdom, but the evolutionary origins of this behaviour remain poorly understood. Mound-building has evolved multiple times independently in the termites, including one occurrence in the Australian *Coptotermes*. Some Australian *Coptotermes* species also nest in living trees, while the most closely related non-Australian species predominantly nest in dead wood. Worldwide, the genus includes some of the most destructive termite pests. We conducted a phylogenetic study of the Australian *Coptotermes* in order to shed light on the evolution of nesting behaviour in this group, sequencing mitochondrial COI and COII and nuclear ITS1 in >100 specimens representing all currently described Australian species. We have found that mound-building behaviour arose at least three times independently within the Australian *Coptotermes*, in all cases resulting in distinctive thick-walled mound architecture. We have used ancestral-state reconstruction and molecular-clock analysis to estimate the timing of the appearance of new nesting types in the Australian *Coptotermes*. Along with the results of logistic a regression analysis using climate data, this suggests that the evolution of new nesting types in the Australian *Coptotermes* coincided with a period of climate fluctuation on the Australian continent. We tentatively conclude that the ancestral Australian *Coptotermes* was a living-tree nester, and that mound-building in the Australian *Coptotermes* arose in response to the increasingly erratic availability of moisture in the Australian environment. Finally, we find that genetic diversity within the Australian *Coptotermes* is greater than previously thought, with a possible three new species discovered.