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Heating the superorganism: colony-level responses to environmental change

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The response of social insects to their environment is dynamic, and results from interplay between individual traits and social interactions. Research on thermal tolerance in ants has focused primarily on forager traits, such as upper thermal limits of individual workers (e.g. CTmax), but temperature also drives colony-level patterns in brood production, metabolism, and growth. Here we combine studies on thermal tolerance of adult workers with measurements of brood development rates. For 15 dominant ant species from the eastern United States, we measured pupal development rate as a function of rearing temperature. Surprisingly, all species converged on nearly the same maximum development rate independent of worker size (~10 days for pupal development). Cold-tolerant species, however, reached this maximum at significantly cooler temperatures than heat-tolerant species. This suggests a tradeoff between brood development rate and worker thermal performance, such that species specialized to forage under warm conditions also require warmer temperatures to fuel colony growth. These findings highlight how epistatic interactions between developing brood and adult workers could shape colony-level responses to warming. Taking into account traits associated with colony growth, in addition to foraging traits, should improve models that seek to understand how social organisms will respond to environmental change.