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The evolution of cuticular hydrocarbon profiles in ants

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Insect cuticles are covered with hydrocarbons (CHC), which serve two main functions: desiccation barrier and information transfer. The CHC profile of an ant carries information on its species identity, colony, caste, sex, etc. During the last years, our knowledge on causes and functions of intraspecific CHC variation has advanced drastically. Intraspecific variation is usually restricted to quantitative changes in hydrocarbon composition, whereas interspecific variation is characterized by qualitative alterations i.e. variation in substance identities and substance classes. To date, little is known about the evolutionary causes of interspecific variation. Moreover, we do not understand the role of phylogenetic or physiological constraints on CHC evolution: How fast can insects adapt their CHC profiles to e.g. new communication needs? How important are constraints for CHC evolution? Here, we analysed the CHC profiles of 37 *Camponotus* and 39 *Crematogaster* species from around the world. We searched for phylogenetic and/or physiological constraints and for selection pressures on CHC composition. CHC profiles did not appear to experience strong phylogenetic constraints. Even sister species could exhibit completely different profiles. However, we identified several physiological constraints. First, dimethyl alkanes and alkenes rarely co-occurred in the same species. Second, we found correlations between hydrocarbon chain length and the proportions of unsaturated compounds and n-alkanes. They might be caused by the need to maintain a specific viscosity of the epicuticular layer. Finally, climate strongly influenced substance class composition. Tropical rainforest species had higher amounts of unsaturated compounds than species from more arid habitats. We explain this by variance in draught stress, as less waterproofing is required in the humid tropical rainforests. The length of the hydrocarbon chains was unaffected by climate, but was higher among ants in interspecific associations. We conclude that CHC profiles can evolve quickly, but experience constraints posed by climatic conditions, interspecific interactions, and CHC viscosity.