Interdisciplinary International BSc/MSc Project

How do ants adapt their chemical "social passport" to environmental changes?

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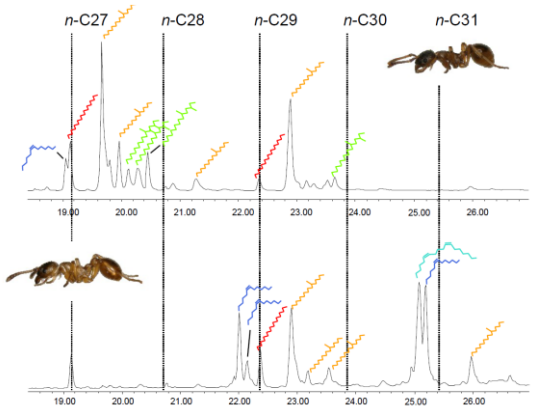
Context. The cuticular layer, which can contain more than 100 cuticular hydrocarbons (CHCs), covers the body surface of nearly all insects. It performs two essential functions: waterproofing the insect body and communication between individuals. In changing climatic conditions, its ability to maintain these vital functions is crucial and is highly dependent on the rheology of the cuticular layer. Waterproofing and communication will only work at the same time if the CHC layer is neither too solid nor too liquid [1-3].



Right: Cuticular hydrocarbons of the ants *Myrmica rubra* (above) and *Myrmica ruginodis* (below). Adapted from [5].

Research questions. Insects experience both short-term (day-night, sun-shade) and longer-term (summer-winter) variation in temperature. How does the cuticular layer remain robust in the event of rapid temperature variations? How do insects adapt the chemical composition of their cuticular layer to regulate its rheology and thus maintain essential functions [1]? These two questions are the focus of this interdisciplinary project. We will investigate the robustness and adaptation of the cuticular layer by studying the relationship between the rheology and chemical composition of CHCs in ants under variable climatic conditions. This is essential for understanding how insects, an animal group that is largely in decline but highly important for us humans, will be able to respond to the challenges of climate change.

Work in the lab. Cuticular hydrocarbons are available in minute quantities, too little for usual rheology techniques. Recently, new developments in the insect world have emerged at Laboratoire Matière et Systèmes Complexes, by combining a fluid collection procedure and the adaptation of a microrheology technique to volumes of the order of 10pL [4]. The motivated candidate will study the viscoelastic properties of CHC profiles of different European and tropical ant species, using these novel techniques. A main challenge of this project is to understand phase behaviour of such complex mixtures.

Where? This exciting project, which spans physics, chemistry and biology, takes place at Laboratoire Matière et Systèmes Complexes (MSC), in Paris 13e. It will be carried out in international and interdisciplinary collaboration with the University of Mainz, Germany. If you are interested or have further questions, please contact **Dr. Bérengère Abou** (berengere.abou@gmail.com).

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