Signatures of environmental adaptation in cuticular hydrocarbon profiles of the invasive ant *Cardiocondyla obscurior*

Insect cuticles are coated with a complex mixture of hydrocarbons (CHCs), including straight-chain saturated alkanes, methyl-branched alkanes, and unsaturated alkenes (Blomquist and Bagnères 2010). These compounds are involved in intraspecific signaling but also protect against desiccation. The composition of the CHC profile can change rapidly, for example in response to local climate or microclimate (Menzel *et al*. 2017; Buellesbach *et al*. 2018). The ability to adjust the CHC profile to local conditions might be particularly important for invasive species, where populations can face novel climatic conditions following introduction to new habitats.

Cardiocondyla obscurior is an invasive ant species originally native to southeast Asia. To date it has established stable populations under varying climatic conditions in different habitats (e.g. Brazil, Florida, Japan, Tenerife and greenhouses in Europe). In addition to being genetically and morphologically different, colonies from different populations are highly aggressive toward each other likely due to differences in their CHC profiles (Schrader *et al*. 2014).

Workers of *Cardiocondyla obscurior* (by Lukas Schrader)

Combining pooled and individual genome resequencing approaches, we are conducting a large-scale comparative population genomic study of populations from Brazil (two distant populations), Tenerife, Leiden, and Taiwan. The analysis of this data will yield valuable information on the genetic diversity within/between these populations as well as on genomic signatures of adaptation. Here we propose to analyze and compare CHCs profiles across these populations and investigate whether CHC profile differentiation is explained entirely by genetic differentiation or whether we find evidence for CHC profile adaptations to climatic conditions. Loci underlying local adaptation can be pinpointed by identifying genomic regions with outlier levels of genetic differentiation (F_{st}). Using Gene Ontology (GO) tools to investigate the possible function of these loci, we can identify genes adaptively evolving associated with CHCs synthesis.

The candidate will have to extract and analyze the CHCs of individuals from the different populations (available from live lab colonies) using our new state-of-the-art gas chromatography–tandem mass spectrometry (GC-MS/MS). Furthermore, the applicant is expected to conduct desiccation resistance assays using an in-house method that compares the survival of ants in dry versus standard humidity conditions. Lastly, by comparing the outcome of the desiccation assay, the CHCs profiles and genotypic data, we will try to narrow down the genetic basis and classes of CHCs underlaying waterproofing in *C. obscurior*.

The applicant will be integrated to the Molecular Evolution and Sociobiology group and benefit from the expertise of other group members headed by Prof. Jürgen Gadau at the Institute for Evolution and Biodiversity (IEB), University of Münster. The IEB currently hosts nine closely interacting research groups covering topics such as evolutionary ecology, phylogenetics, biocomplexity, and evolutionary bioinformatics in animals, plants and microorganisms. Further information on the institute and our group is available on the webpage of the IEB: https://www.uni-muenster.de/Evolution/molevolsocbio/

Münster is famous for its many bicycles probably due to its close location with the Netherlands. This beautiful city is located in the lands of North Rhine-Westphalia and has a homey feeling and numerous greens and parks to relax in. It is a lively city and its high number of students makes it a particularly rich environment for social and cultural activities.

If you are Interested or have questions about the project and/or living in Münster, please feel free to contact me at: merrbii@uni-muenster.de

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