CAVEheAT

The CAVEheAT project: climate change, thermal niche and conservation of subterranean biodiversity

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Introduction

One of the main challenges in disciplines such as ecology, biogeography, conservation and evolutionary biology is to understand and predict how species will respond to environmental changes, specially within a climate change context. We focus on species of the deep subterranean environment to minimize uncertainties in predictions, because caves are one of the few ecosystems in nature whose environmental conditions are as homogeneous as could be obtained in a laboratory and their species cannot accommodate to changing conditions by behavioral plasticity, dispersal or microhabitat use (i.e., the only possibility to cope with climate change for these species is to persist in situ). The hypotheses established for this proposal are based on the exciting results obtained in some of our previous studies, in which, we did not find differences between thermal tolerances of different subterranean beetles living under different environmental conditions, suggesting a lack of evolutionary adjustment to ambient temperature for these species. This could be due to the fact that these species have lost some of the physiological mechanisms related to thermal tolerance due to their likely high metabolic cost in a stable environment but with severe resource restrictions. However, the question that remains is to what extent this surprising narrow and homogeneous thermal niche is common for the whole subterranean biodiversity, and how this issue could determine the fate of subterranean biodiversity to climate change. In this project, we are testing for the generality of these exciting previous findings by **studying the thermal niche (species acclimation abilities and thermal tolerances) of different lineages of cave beetles with different degrees of specialization to subterranean environments** and from different geographical areas (Pyrenees and Cantabrian Mountains).

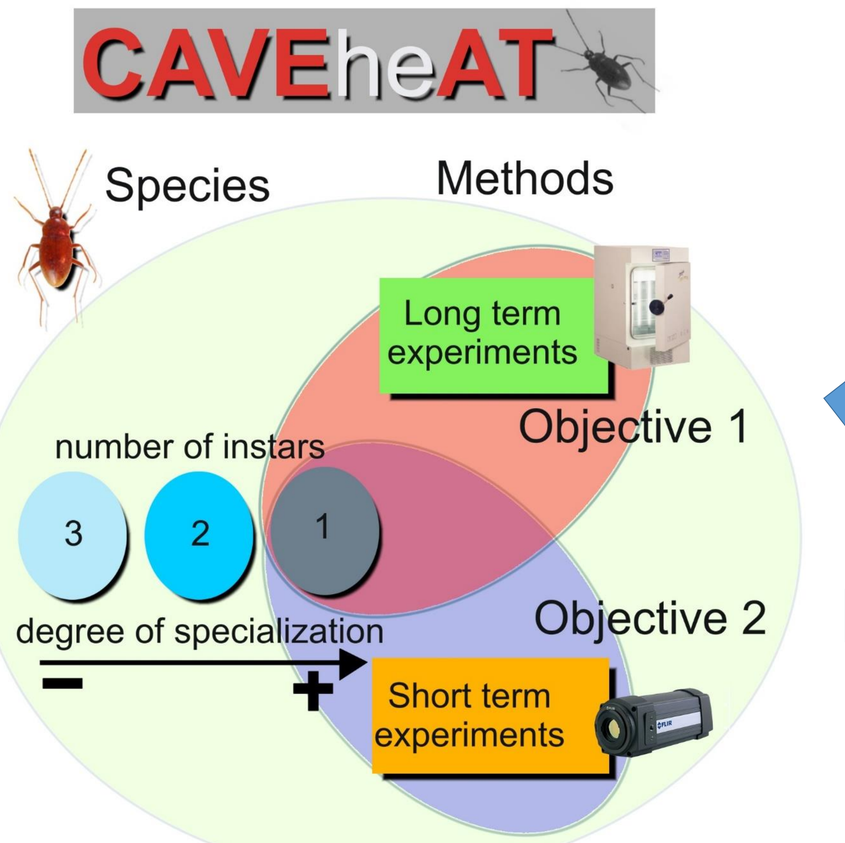
Objectives

O1. To test for differences in the thermal tolerances of species within highly specialized clades (considering both geographical area and different clades).

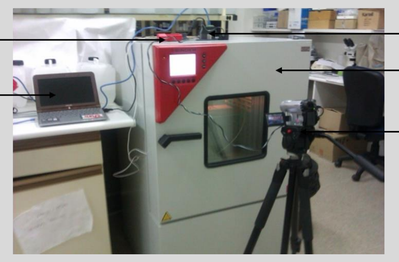
O2. To test if species from deep subterranean environments have thermal acclimation capability.

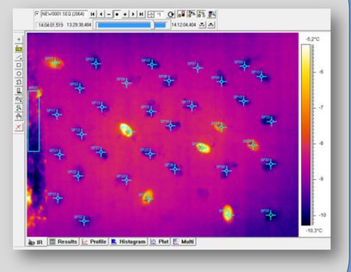
O3. To study the relationship between thermal niche features (upper thermal tolerance and acclimation capability) and the degree of specialization of species to deep subterranean environments.

O4. To assess the capability of different species and populations to face climate change using the physiological information gathered for the previous objectives.

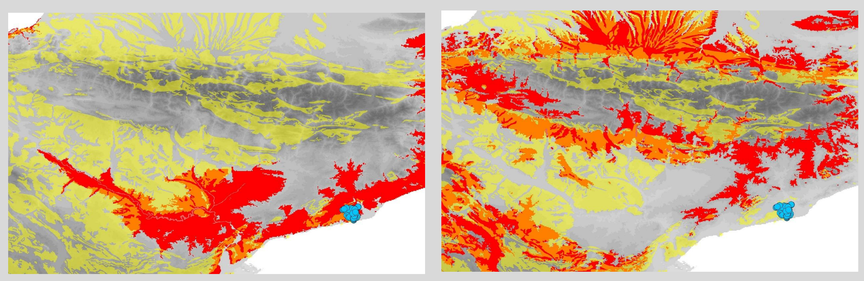


Climatic chambers at the ICAM (UCLM, Toledo) used to carry out long-term experiments





Infrastructure to conduct short-term experiments (University of Murcia). Thermal image of the beetles during the experiment



Troglocharinus ferreri, distribution (blue dots) and areas with suitable **current** (left) and future (right) temperatures

Results

Coming soon…..

The results of this project could provide important insights to improve our ability i) to understand changes in thermal niche during the process of colonization of deep subterranean environments and ii) to predict changes in biological communities that are exposed to global warming effects. Thus, contrary to the general theory that high altitude species will be at high extinction risk under future climatic conditions, we could demonstrate that subterranean species living in warmer areas will be the most vulnerable to an increase of temperature. The lack of adjustment could also mean that for those species already close to the upper limit of their fundamental niches, the possibilities of survival are severely limited.

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