

Scientific Report: Testing the thermal melanism hypothesis in insular lizard populations

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Melanism, the occurrence of variant individuals that are mostly or completely dark, is a common type of polymorphism in many different animal groups. Although a variety of hypotheses have been put forward to explain the phenomenon (e.g. thermoregulation, cryptic coloration, aposematism, protection from UV radiation, desiccation tolerance, disease resistance and sexual selection), the exact reasons for its frequent occurrence remain unclear. Even the most widely recognized explanation, the thermal melanism hypothesis (TMH) is currently debated. The goal of this undertaking was to set up a research program that will allow us to test the TMH (and alternative hypotheses) in island populations of lacertid lizards. We also intended to explore a potential study system with *Podarcis melisellensis* populations in the Adriatic Sea and to collect preliminary data.

With the funding granted by the ESF Programme on "Thermal adaptation in ectotherms: Linking life history, physiology, behaviour and genetics", we were able to meet with the Irena Grbac, who is in charge of the herpetology section of the Natural History Museum in Zagreb. We discussed scientific issues related to (thermal) melanism and to set up a detailed research scheme to test our ideas in the near future. In addition, because we met on the Island of Vis, we were able to make a prospective trip to a number of close-by islets with (reputedly) melanistic individuals. We made preliminary observations relevant to the TMH.

Our survey of the 21 islets around Vis revealed two completely melanistic *P. melisellensis* populations (on Brusnik and Kamik), one semi-melanistic population

(on Mali Barjak) and 11 “normally” coloured ones. The study system therefore seems a good starting point for a larger project on island melanism. Because testing evolutionary explanations will require input on the phylogenetic relationships among the respective populations, we collected tissue samples from every island of the archipelago. We measured (external morphology, scalation patterns) and photographed large numbers of individual lizards from all 14 inhabited islands. We assessed the reflective properties of individuals from the (semi-)melanistic and a selection of “normal” populations using a spectrophotometer. In five populations, we collected a first set of thermal characteristics (field body temperatures, selected body temperatures, thermal dependency curves, heating and cooling rates) and laid out data loggers to obtain information on operative temperatures.

In combination with data that will have to be gathered in future visits to the study area, these data should allow us to explicitly test TMH in this study system. We plan including other species and populations exhibiting similar polymorphism in the future to check the generality of our conclusions. In addition, we plan to consider and test alternative explanations of melanism and have already started collecting data relevant in that context (e.g. parasite load, immunity, desiccation rate).

In summary, this study visit has allowed us to set up a promising joint research program and to explore a potentially interesting study system. We have decided to initiate an intensive partnership with the Croatian team on this subject, and hope to expand this collaboration to other groups tackling similar questions in other study systems. We are currently performing laboratory tests with the specimens caught in the Vis study system and feel confident that the combination of these data with the preliminary field data will allow us to prepare one or two joint publications. More publications will follow after future visits of the study area.