



ENBE 2025

**XXI International Meeting of the
Portuguese Association for Evolutionary
Biology**

BOOK OF ABSTRACTS

18th-19th December 2025

Bragança

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TOPIC 2 | DOMESTICATION, POPULATION GENOMICS AND CONSERVATION

POSTER 6 | ADAPTIVE GENOMIC VARIATION IN HONEY BEES FROM ARID REGIONS

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Abstract

The Middle East is home to a large number of *Apis mellifera* subspecies that have evolved under extreme aridity and desertic conditions. Therefore, they represent a unique opportunity to disentangle the genetic basis of adaptation to such challenging environmental conditions. We arranged a collection of 514 drone samples (haploid males) split into two latitudinal transects. Transect 1 comprised 342 samples: 66 *A. m. lamarckii* (Egypt), 197 *A. m. syriaca* (Jordan), 30 *A. m. syriaca* (Lebanon), 21 *A. m. meda* (southeastern Turkey), and 27 *A. m. anatoliaca* (Anatolia, Turkey). Transect 2 comprised 173 samples: 14 *A. m. jemenitica* (Oman), 9 *A. m. jemenitica* (UAE), 75 *A. m. meda* (Iran), and 75 *A. m. caucasia* (northeastern Turkey). For all samples, whole genomes were resequenced, and environmental and bioclimatic variables were retrieved from WorldClim. For each transect, we applied three genotype–environment association methods (Samβada, pRDA, and LFMM) and one outlier-detection approach (PCAdapt) to identify SNPs associated with environmental adaptation. SNPs were annotated, and the intersection of genes between the four methods in each transect was analysed for gene enrichment. In both transects, enriched terms included genes related to biological regulation through endocrine, neuroendocrine, and neurotransmitter pathways. The regulation of gene expression was also enriched, including several transcription factors, especially HOX genes. Transmembrane and ionic transporters also seem to play a central role in environmental adaptation in these subspecies. Finally, neurogenesis, synapse establishment, and neural system development were also enriched. When gene enrichment analysis was set to exclude electronic annotations (automatically assigned, non-curated GO terms), enriched terms included processes such as behaviour, learning or memory, cognition, and associative and olfactory learning and behaviour. Our findings point to a complex suite of regulatory and sensory