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Conservation of European M-lineage Honey Bees Using Abdominal Colour as an Indicator of Subspecies Purity has Pitfalls

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Abstract:

There are 31 honey bee (*Apis mellifera*) recognized subspecies, which have been grouped into four main lineages. Two of these lineages occur naturally in Europe: M in western and northern Europe and C in south-eastern Europe. In Europe, M-lineage groups only two subspecies, *Apis mellifera mellifera* and *Apis mellifera iberiensis*, both being black in colour. C-Lineage groups have instead eight subspecies, including one of the beekeepers-favored and phenotypically distinct, the yellow *Apis mellifera ligustica* from Italy. M-lineage honey bees' distribution has been changing and in some countries, the native bee is being replaced or hybridised with C-lineage subspecies. Honey bee abdominal pigmentation is one of the most recognisable traits and it has been used by beekeepers as an indicator of subspecies identity. However, this approach may negatively impact population diversity and is futile if there is no association between tergite colour patterns and genetic background. To test this approach, we calculated the introgression level of *A. m. mellifera* (N=162) and *A. m. iberiensis* individuals (N=559) with different colour phenotypes and from a wide geographical range using informative SNPs. In this study, many *A. m. mellifera* samples showed high levels of C-lineage introgression. The individuals collected in Iberia were revealed to be pure. Introgressed *A. m. iberiensis* individuals were all from the Azores, where a high frequency of C-lineage mitotypes exists in several islands. Our results showed that for both subspecies, it is not possible to directly identify introgressed individuals from observed colour patterns, as we found black honey bees with a considerable amount of introgression and honey bees with yellow banding that were pure or marginally introgressed. With this study, we hope to increase awareness among stakeholders of the need to use other tools to select honey bees for conservation and breeding purposes.

Keywords: *Apis mellifera mellifera*, *Apis mellifera iberiensis*, SNPs, yellow banding, conservation

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