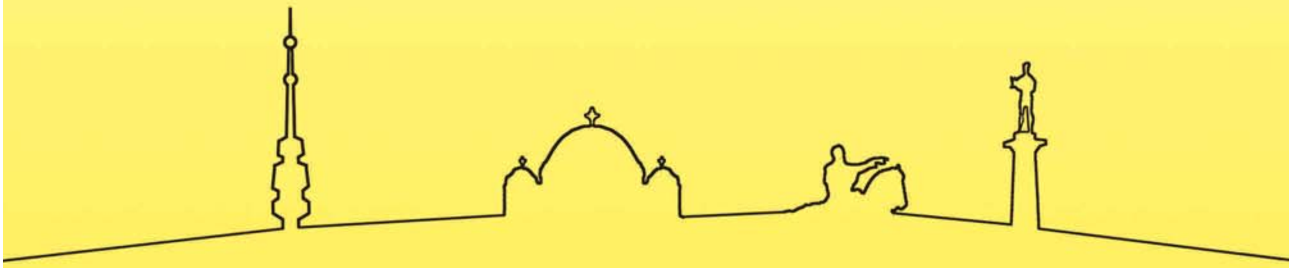
EurBee 9
9th European Congress of Apidology
20-22 September 2022
Belgrade, Serbia

Abstract Book



DEEPWINGS©: A MACHINE LEARNING TOOL FOR IDENTIFICATION OF HONEY BEE SUBSPECIES

Yadró, Carlos, Centro de Investigação de Montanha, Instituto Politécnico de Bragança, Bragança, Portugal
Rodrigues, Pedro J., Research Center in Digitalization and Intelligent Robotics (CeDRI), Instituto Politécnico de Bragança, Bragança, Portugal
Adam Tofilski, Department of Zoology and Animal Welfare, University of Agriculture in Krakow, Krakow, Poland
Elen, Dylan, School of Natural Sciences, Bangor University, Bangor, United Kingdom
McCormack, Grace Patricia, Department of Zoology, School of Natural Sciences, National University of Ireland Galway, Galway, Ireland
Henriques, Dora, Centro de Investigação de Montanha, Instituto Politécnico de Bragança, Bragança, Portugal
Pinto, M. Alice, Centro de Investigação de Montanha, Instituto Politécnico de Bragança, Bragança, Portugal

DeepWings© is a software that uses Machine Learning for fully automated identification of *Apis mellifera* subspecies based on wing geometric morphometrics (WGM). Here, we examined the performance of DeepWings© under realistic conditions by processing 14,782 wing images with varying quality and produced by different operators. These images represented 2,593 colonies covering the native ranges of *A. m. iberiensis* (Portugal, Spain and historical introduction in the Azores), *A. m. mellifera* (Belgium, France, Ireland, Poland, Russia, Sweden, Switzerland, UK) and *A. m. carnica* (Croatia, Hungary, Romania). The classification probability obtained for the colonies was contrasted with the endemic subspecies distribution. Additionally, the association between WGM classification and that inferred from microsatellites and SNPs was evaluated for 1,214 colonies. As much as 94.4% of the wings were accepted and classified by DeepWings©. In the Iberian honey bee native range, 92,6% of the colonies were classified as A. m. iberiensis with a median probability of 91.88 (IQR = 22.52). In the Azores, 85.7% of colonies were classified as *A. m. iberiensis*, with a median probability of 84.16 (32.40). In the Dark honey bee native range, 41.1 % of the colonies were classified as *A. m mellifera* with a median probability of 99.36 (8.02). The low percentage of colonies matching the native subspecies was mainly due to the low values registered in Avignon (20.0%), Poland (32.9%), and Wales (41.2%). In contrast, most of the colonies analyzed in other locations of the native range of *A. m. mellifera* matched this subspecies: Belgium (100.0%), Groix (63.9%), Ouessant (72.7%), Ireland (78.0%), Russia (96.2%), Sweden (84.2%) and Switzerland (55.6%). In the colonies from Croatia, Hungary, and Romania, 88.0% of the samples were classified as *A. m. carnica*, with a median probability of 98.49 (6.76). The association between WGM and molecular data was highly significant but not very strong (Spearman r = 0.31, $p < 0.0001$). A good agreement between morphological and molecular methods was registered in samples originating from highly conserved M-lineage populations whereas in populations with historical records of foreign

queen importations the agreement was weaker. In general, DeepWings© showed good performance when tested under realistic conditions. It is a valuable tool that can be used not only for honey bee breeding and conservation but also for research purposes.

Keywords: Wing Geometric Morphometrics, *Apis mellifera* subspecies classification, honey bee conservation

SEMI-NATURAL HABITATS PROMOTE WINTER SURVIVAL OF WILD-LIVING HONEYBEES IN AN AGRICULTURAL LANDSCAPE

Rutschmann, Benjamin*, Department of Animal Ecology and Tropical Biology, University of Würzburg, Würzburg, Germany
Kohl, Patrick L.*, Department of Animal Ecology and Tropical Biology, University of Würzburg, Würzburg, Germany
Machado, Alejandro, Asociación Ridimoas, Ourense, Spain
Steffan-Dewenter, Ingolf, Department of Animal Ecology and Tropical Biology, University of Würzburg, Würzburg, Germany

* these authors contributed equally

The diversity of endemic honey bee subspecies and ecotypes is at risk in Europe because modern apiculture promotes only a small number of honey bee strains. A crucial step for the conservation of honey bee diversity is the assessment of the status of remaining wild populations and their limiting factors. Here we present a two-year census of native, wild-living honey bees inhabiting power poles in an intensive agricultural landscape in Galicia, NW Spain. The autumn colony densities were at least 0.22 and 0.17 colonies/km^2 and winter survival rates were 59 % and 26 % for the years 2019 (N = 29) and 2020 (N = 23), respectively. Both the initial occurrence and the subsequent winter survival of the colonies were positively correlated with increasing proportions of wood- and shrubland in the surroundings in both study years. These observations highlight the importance of semi-natural habitats for the conservation of wild-living honey bees.

Keywords: wild-living honeybees, power poles as nest sites, semi-natural habitats