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Sustainable Beekeeping, *from the south of the world*

ABSTRACT BOOK

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PP-380
MEDIBEES: Monitoring the Mediterranean honey bee subspecies and their resilience to climate change for the improvement of sustainable agro-ecosystems

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Beekeeping provides livelihood for hundreds of thousands of beekeepers in the Mediterranean area. This activity relies on a number of different indigenous Apis mellifera subspecies, adapted to the very diverse and harsh conditions of the region. Climate change is expected to increase the stress factors affecting bees, especially in this region, reducing both pollination efficiency and production potential. Unfortunately, our ability to address this problem is limited by the incomplete knowledge of the natural adaptation mechanisms developed by the different subspecies. In order to increase the knowledge base for future selection programs to improve bee populations for environmental changes, the MEDIBEES project is being developed. It includes 9 partners from 8 Mediterranean countries on all three shores of the Mediterranean, covering 10 local A. mellifera subspecies, which represents a remarkable though understudied proportion of the species genetic diversity. The project aims to: a) unravel the differential genetic background of Mediterranean subspecies, b) understand their adaptation to local conditions, and c) characterize their resistance to climate change. To achieve the objectives, colonies belonging to the local subspecies will be studied phenotypically to determine their behavior under environmental conditions, covering survival, sensitivity to pests/pathogens, behavior, physiology and reproduction which will be completed by gene expression and transcriptomic assays. In addition, complete genomes of field and laboratory samples will be sequenced to find genes putatively involved in adaptation and to develop new genetic tools to characterize honey bee populations according to their resistance to environmental stress factors. This effort will encourage the use of local subspecies, to make them more attractive and avoid importing foreign breeds, and will lay the foundation for future selection programs. Besides, the valorization of honey by both promoting its use and developing quality labels, and the evaluation of beekeeping by-products as modifiers of soil fertility and biota are also approached to help the beekeepers improve the sustainability of their farms in an economical and environmental sound manner.
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Accuracy analysis of two evaluation methods for the area of capped brood in honey bees hives

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Evaluation of colony development is usually conducted at the beginning or during an experiment when the hives are standardized and/or at the end as response variables. Adult bees in a colony vary in number according to the time of day, weather conditions or resource availability. Therefore, evaluating the brood is more reliable and can be accomplished through a) objective methods (OM), such as analysis of brood area with ImageJ, and b) subjective methods (SM) where one or more operators estimate the brood area while observing the hive. OM are precise but require a lot of time for image analysis. SM are quicker but could be imprecise and/or inexact. Recently, a semi-automatic method called CombCount (CC) was developed, which allows quick image analysis. Our goal was to evaluate the precision of the CC and SM in the measurement of the area of capped brood. Four hives with capped brood were used: they were photographed and estimated by 2 trained operators. Images were analyzed with ImageJ and these results were compared against those obtained by CC and SM, and were analyzed statistically. In the comparison between CC and ImageJ, the regression line (y=0.8585x + 0.2023, R2=0.962) is closer to the ideal of perfect agreement (y=x), than the MS vs ImageJ regression line (y=1.2033x + 0.8837, R2=0.967). Lin's coefficient, an index that evaluates the concordance between measurement methods, yielded a "substantial" value (McBride, 2005) of 0.9627 for the first analysis. For the seconds analysis, a "moderate" Lin coefficient (McBride,2005) of 0.9384 was obtained. The parameters that measure the precision of the method (Cb- bias correction factor, Location shift, Scale shift) were better for CC, and the difference in precision (r) between both groups was minimal. Comparing the two Lin's coefficients, it can be observed that CC has a slightly higher level of concordance with the Gold Standard ImageJ than SM. Both methods, CC and SM, can be used alone or in combination during an experiment: CC eliminates the main disadvantage of the OM, which is the time required for an analysis, while SM with trained operators are more precise than originally thought.