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MAPPING AND MONITORING WESTERN HONEY BEE UNMANAGED COLONIES

Mappare e monitorare le colonie non gestite dell'ape mellifera

The Western honey bee *Apis mellifera* Linnaeus, 1758, the one managed by beekeepers, is a native insect in almost all of Europe, Africa and the Near East where is one of the main pollinators of the flora (both wild and cultivated). Although *Apis mellifera* have been reared by humans for millennia, it remains a wild animal) as reported by ancient authors and modern beekeepers and researchers (Fontana *et al.*, 2018).

Until a few decades ago, colonies of wild (i.e., unmanaged) *A. mellifera* were largely common: in hollow trees, in holes in the ground, in cracks in rocks but also in buildings, abandoned and not. However, since the early 1980s there has been a rapid and underestimated rarefaction of the "wild" colonies due to a parasite, the fearsome Varroa destructor mite. This parasite initially decimated, both with its direct action and due to the viruses, it transmits, both unmanaged honey bees and those managed by beekeepers, with the difference that the latter immediately understood how to protect their colonies with different techniques also including the massive use of acaricides. The effect of the Varroa mite on unmanaged colonies was instead so strong that today in Europe most of the survived honey bees live in hives managed by beekeepers (Fontana, 2019). Indeed, for many years it has even been thought that in Europe wild honey bees were disappeared. Rather surprisingly, there are no scientific studies on this phenomenon and the only available information deals with the number and distribution of honey bees colonies owned by beekeepers. In recent years, however, there has been a significant increase in reports of unmanaged colonies, probably due to the grow-

ing empathy of people for this insect, which is important for ecological services but that at the same time is threatened by anthropic factors such as environmental simplification, the widespread use of pesticides and climate change.

Unmanaged honey bee colonies are primarily important because they are a natural component of our European habitats. A single colony of honey bees can pollinate several billion flowers in a year. *Apis mellifera* foraging bees can be active for almost 9-12 months a year (depending on the climatic regions) and because of the large range of action, the pollination carried out by a single colony can cover an area over 30 km^2.

Unmanaged colonies of *A. mellifera* are also important for the same beekeeping because they are more directly subject to natural selection. In fact, in these colonies are more likely selected characters of resistance and/or tolerance to parasites and diseases but also of adaptation to local ecological and climatic conditions as well as to their change over time. The unmanaged colonies are then of fundamental importance for the conservation of local subspecies and populations of *Apis mellifera*. Therefore, knowing the real distribution of the unmanaged *A. mellifera* colonies, living outside the beekeepers' hives, is very important and that is why Fondazione Edmund Mach created the BeeWild mobile application, which can be downloaded for free (and free from advertisements of any kind) both from Play Store and App Store. The BeeWild app allows citizens, through a typical Citizen Science action, to report the presence and survival over time of unmanaged colonies of *Apis mellifera*, geolocating them, also providing some simple observations relating to the environment, the exact location and position of the nests, and allowing users to attach one or more photographs. Obviously, the reports, before appearing in the App map, must be validated by a group of experts who ascertain first of all if it is an unmanaged *Apis mellifera* colony, and then if the provided images do not affect the privacy of citizens and beekeepers in any way.

In building the BeeWild App, we were faced with a question of crucial importance. Is it right or not to make available to all BeeWild users (through a detailed map) the exact location of the surveyed colonies? After several discussions between scientists of many European countries (which were involved in the definition of the contents and objectives of BeeWild), it was decided that the possibility for citizens to geo-locate previously registered colonies would have permitted us to achieve a fundamental information: the survival over time of the colonies. From the most recent and exhaustive literature (e.g., SEELEY, 2010, 2019), we know that unmanaged colonies have a high mortality rate. Three out of four swarms of the year generally do not survive the winter and one in four colony of those living in previous years does

not make it. So, 50% of these colonies die each year. Natural selection is truly ruthless towards honey bees, but it is precisely this that over the millennia has made the beehive a superorganism so strong and resilient.

BeeWild is a project conceived to be operational at a European level and for now it works both in Italian and English but in the near future it will be implemented with other EU languages. The BeeWild App was launched on 7th August 2020 and thanks also to a media campaign, a relevant number of citizens downloaded it and consequently also the number of unmanaged colonies surveyed.

Once opened, the App has three options: (1) to open the map of reports, (2) to make a new report and (3) to consult the guide. The guide has been written in a simple but exhaustive way, to let any reader to understand the aims of the project, some basic info about the bees and how to use the App.

On 31st March 2022, the BeeWild App was downloaded by over 2555 people and the active ones (app installed) are 519 on Android and about 300 on iOS. Of these, 346 have registered and 107 have become "guardians" of one or more colonies. 268 colonies were registered (almost all in Italy) and among these, 213 were reported for more than one time, while colony death was reported in 21 cases.

Perhaps the most interesting data concerns some simple aspects relating to the nesting sites of these unmanaged colonies. We found a high variability of cavities chosen by the bees at different heights from the ground. As regards the type of nest, it is interesting to note that 57.46 % (154) of the validated colonies have nested in a wall cavity or in architectural elements, in urban environment while 22.39 % (60) of them inside tree trunks either alive or dead, standing or laid on the ground. Probably due to their easier visibility, 3.36 % (9) of the reported nests are located outdoor on trees or attached to rocks or buildings. As for the height from the ground, 38.43 % (103) of the nests were found between 2 and 5 m and 21.64% (58) between 5 and 10 m. In general, 66.04 % (177) of the colonies settled at a height over 2 meters from the ground. These data are perfectly in line with what is highlighted by the studies of Thomas D. Seeley (2010, 2019).

The data collected so far could lead us to hypothesize that in sites where there is a large availability of cavities suitable for nesting and where there are a certain number of active unmanaged colonies and still free or abandoned sites, survival is overall greater. From this very preliminary observation it could be concluded that not only *Apis mellifera* is a social organism organized in superorganisms, but that the colonies of a site constitute a sort of community, fundamental for the survival of the different colonies. From these first and simple analyzes, an interesting and very promising picture emerges. Obviously, with the progress of the reports BeeWild has the potential to be a

very important tool to conduct a large-scale study of the unmanaged colonies of *A. mellifera*. This research topic has been poorly studied up to now in Italy and in most of Europe and the acquired knowledge will bring new insights both on the *A. mellifera* biology and on the quality of the environment.

Aknowledgements — We thank all citizens who have grasped the great importance of this census and who are providing data on unmanaged honey bee colonies through the BeeWild app.

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