



Particulate matter collection by honey bees (*Apis mellifera*, L.) near to a cement factory in Italy

Marco Pellecchia, Ilaria Negri

BACKGROUND

Industrial activities play a key role in the economic well-being of a country but they usually involve processes with a more or less profound environmental impact, including emission of pollutants. Among them, much attention has been given to **airborne Particulate Matter (PM)** whose exposure is ubiquitous and linked with several adverse health effects mainly due to its size and chemical composition.

WHAT IS PARTICULATE MATTER?



PM is a complex mixture of airborne chemicals classified according to the diameter which may range from several micrometers (PM10) to a few nanometers (PM0.1). Finer particles may penetrate deeper in the airways tract and ultrafine particles may even enter the brain directly, posing hazards to human health.

Photo: The cement factory (Koiné S.n.c. 2016)

THE ROLE OF THE HONEY BEE

The honey bee (*Apis mellifera*, L.) is widely used as an indicator of environmental pollution: this social hymenopteran strongly interacts with vegetables, air, soil, and water surrounding the hive and, as a consequence, pollutants from these sources are translated to the insect and to the hive products. During the wide-ranging foraging activity, the forager bee is known to collect samples of the main airborne PM pollutants emitted from different sources and therefore **it can be used as an efficient PM sampler.**



THE STUDY

In the present research, **PM contaminating forager bees living nearby a cement factory** and several kilometers away from it has been analysed and characterised morphologically, dimensionally and chemically through SEM/EDX. This **provided detailed information on the role of both the cement manufacturing activities and the vehicular traffic as sources of airborne PM.**

Photo: Bee hives close to the cement factory (Koiné S.n.c. 2016)

RESULTS

We found considerable evidence of particulate matter on bees (PM10, PM2.5, PM1 and PM0.1), that can be attributed to cement manufacturing activity and vehicular traffic.



Please see figures 3-15 in the manuscript for more details

CONCLUSION

The honey bee is an ideal pollution-sensing drone able to provide the following advantages: (i) limited purchase costs and maintenance; (ii) a unique sampling system, (iii) an environmental friendly approach; (iv) the simultaneous collection of a wide range of pollutants, including airborne Particulate Matter.

Our results may help the implementation of appropriate preventive and corrective actions that would effectively minimize the environmental spread of pollutant PM not only in areas close to the plant, but also in more distant areas.