



# 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.