

24 YEARS

Gérard Arnold – Now I began to get interested in bees a mighty long time ago, then up came the question of pesticides in about the year 2000, where I wanted to get involved as a researcher with knowledge on the biology of bees and the behaviour of bees. I wanted to use my knowledge to address the question: does this or that insecticide affect bees and if so, why? Being a neurobiologist, I was interested in the antennal lobes of bees, in the olfactory system of this insect and ultimately in the neuromediator, a molecule that is important for the function of the nervous system, this being acetylcholine. Now the molecules used in insecticides, the neonicotinoids, target the receptors for acetylcholine. It was therefore easy to show why such a toxic molecule could have effects on the brains of bees and hence on their behaviour. Among the neuronal behaviour affected is their sense of orientation and it was established several years ago that exposure to neurotoxins, in particular to the neonicotinoids, provokes trouble in the recognition of space and in orientation. As a result, a bee that has gathered pollen and nectar from these plants cannot easily find its way back to its hive. And in short order it will die in the wild after a few hours or days.

There are many researchers who have been able to show that very weak doses of these molecules affect the survival of bees, particularly by repeated ingestion of very small quantities, and that's pure research work, with samples, controls, statistics etc. Now we should not blame pesticides alone, that wouldn't make sense, for example there is also an acarien parasite called varroa that does damage in hives, there may also be influence from climatic effects on blossom, but among all these factors the pesticides play a special role. Particularly in heavily cultivated areas, bees are usually exposed not only to one pesticide in particular or just one family of pesticides but to mixtures of products! And it is these mixtures that are probably more toxic again than one single product or one single family of products. And it is this question now that is a true topic of research, with the need for analysis and study of the effects of mixtures and different doses of constituent in the mixtures in order better to understand and preserve bees.

Now there is a social bee, *apis mellifera*, that lives in summer as spending three weeks within the hive and next they go out for about eight days to gather pollen in the wild. And the life-span of these pollen-gatherers is important and if something causes there to be fewer pollen-gatherers, intoxicants for example, this has very rapid effects on the colony. That is because the younger bees that are at an age where they should be nurturers must become pollen-gatherers more rapidly. The result is that there are fewer nurturer bees and the brood, the larvae, suffer.

Work at the EFSA in particular showed that pesticides available on the European market had not been evaluated correctly. That's a study from 2012 which led the European Commission to suspend certain molecules. In the future, it is very important that before being released onto the market, pesticides are properly evaluated so as to avoid ensuing health disasters and also because it is very difficult to withdraw a product that has been accredited. This was seen in the case of neonicotinoids and in particular of imidacloprid, from the first warnings from beekeepers in about 1995 until the recent withdrawals in 2018 it took roughly twenty four years! That means that twenty four years were needed to withdraw all the neonicotinoids from the French market with only three of these being withdrawn in Europe. Now that's too long, much too long, and during all this time there were losses to our stock of bees and perhaps to other organisms.

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