An overall evaluation of the impact of electromagnetism on bees, and consequently an attempt to remedy

Marie-Claire Cammaerts[(1)]

(1) Independent researcher, Bruxelles.

Contact author: email: mccammaerts@gmail.com

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Contact author: Marie-Claire Cammaerts, 27 Square du Castel Fleuri, 1170 Bruxelles, Belgium; n° telephone: 32 2 673 49 69

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Abstract

The decline of bees (the CCD) all over the world is an important still not solved problem. Its reasons are numerous: the use of pesticides and insecticides, the lost of plant diversity, bee's parasites ... However, there is a potential factor, little considered: manmade electromagnetism, the effects of which largely increases nowadays, and to which bees are very sensitive. The present paper suggests two simple ways for revealing the potential adverse effect of electromagnetism on bees and to act consequently. One is the observation of bees' avoidance against a wireless apparatus; the other one is the assessment of the electromagnetism field (EMF) surrounding the hives together with the state of health of their bees. If bees avoid a wireless apparatus, if hives in bad health are located in EMF of rather high intensity, it can be presumed that bees are affected by manmade electromagnetism. This should enable looking for palliative measures.

Key words: electromagnetism, insects, memory, nervous system, wireless technology.

Introduction

The nowadays nearly world-wide decline of the bees (*Apis mellifera* Linnaeus, 1758), known as the colony collapse disorder (CCD) [1, 2], has not begun with the use of insecticides and pesticides but later on, and did not decrease (on the contrary!) when the use of such products has been controlled and limited. Of course, such substances imperil the bees, but they may not be the only cause of the CCD. In presence of insecticides or pesticides, bees die and are found dead all around the hives. This occurs, effectively [same references as above]. However, in numerous other cases, no dead bee can be seen either inside the hives or all around them, while lower and lower numbers of bees remain inside the hives [3]. Another cause of the CCD is the decrease of available adequate flowers, of different species, and thus of the plant biodiversity [4]. There are also other local, punctual causes, such as the presence of parasites (i.e. *Varroa destructor* Anderson & Truema, 2000), fungi, predators (i.e. *Vespa velutina* Lepeletier, 1836) [5]. All these factors, actually often under control, cannot explain the drastic collapse of so many bee colonies all over the world. Another possible cause is an event which started at the same time the CCD stated and the extent of which increases days after days in every country: the existence of manmade electromagnetic fields. The wireless technology appeared just sometime before humans became conscious of the CCD; this technology progressed continuously, and is still increasing, just like the CCD [5].

There are several elements in favor of an adverse effect of manmade waves on the bees' health. Electromagnetism affects all living organisms: unicellular ones, insects, amphibians, birds, mammals among others. There exist several reviews on the subject [e.g. 6, 7, 8]. The insects are very sensitive to EMF. Working on ants, we discovered that under EMF, they eat far less, collect nearly no food, recruit no longer nestmates, present locomotion problems, have a decrease of cognitive abilities, respond less to their pheromones, cannot acquire as usually visual as well as olfactory conditioning, and have no longer any memory (they cannot be conditioned, they can no longer find their nest entrance, they can no longer come onto the food site, for instance). Moreover, the development of their larvae and nymphs is severely impacted [9, 10]. Finally, using *Paramecium caudatum* as a model, we discovered that EMF affects the cellular membrane [11], what has been also found and then explain by other researchers [12]. Since the cellular membrane is damaged under waves, the nervous system functioning also becomes perturbed [13, 14, 15]. This explains the ethological and physiological abnormalities observed on ants under EMF. This explains also their perturbed larval and nymphal development since these phenomena are controlled and induced by secretions of the brain pars intercerebralis. If ants are severely impacted by electromagnetism, other insects should be too. Indeed, impact of EMF on insects, including bees, has been observed, examined and related by many researchers [16, 17, 18, 19 and references therein, 20]. Before the invention of the wireless technology, plenty of active insects fled on crops, flowers, fruits, where they eat, drunk, gathered nectar, and numerous dead insects were found crushed on cars. All this no longer occurs nowadays [2]. Birds are also affected by EMF. Since moreover most of them eat insects, at least during a part of the year, their numbers actually decrease [21]. Bees may be particularly affected by manmade electromagnetism: while flying, they can cross electromagnetic fields of high intensity generated by masts, and they may be especially affected because they have magnetite in their brain, a compound which reacts to magnetism. When crossing an electromagnetic field of high intensity, bees no longer remember their way, can no longer fly in the correct direction, and cannot go back to their hive. Alone, a bee cannot live; it dies in about two days, far from its hive. This may at least partly account for the CCD. At a more general environmental point of view, the bees' CCD reveals a global situation; it reflects what is actually occurring, for the nature, all over the world. If such a situation persists, pollinators will cease to be numerous enough for assuring pollination. Let us add that EMF also affects plants [22, 23, 24, 25].

To come back to bees, humans presently tempt to limit the use of pesticides and insecticides, and to preserve biodiversity. However, nothing is done for decreasing the amount of manmade waves in nature, and/or to protect bees. Electromagnetism is not considered as an adverse factor, as an element imperiling the bees (and other living organisms) because humans

intensely use the wireless technology, and are now even dependent on it for their work, recreational activities or simply for living. Here below, two easy experiments are proposed for examining to which extent bees are impacted by EMF, what may lead us to act consequently, i.e. to set hives in secure place. Any beekeeper or anyone knowing a beekeeper is invited to make either the first, or the second, or the two experiments proposed in the present paper.

Material and Methods

First, we propose that each self-willed beekeeper makes, at his (her) convenience, a simple experiment in front of one or a few hives, using a GSM or any wireless apparatus. Secondly, we recommend any beekeeper (or anyone knowing a beekeeper) to collect information on hives' health and surrounding EMF. We ask any participant to send us their assessments, so that we can establish a relation between bees' health and EMF. Of course, thereafter, we shall divulgate the results of such an analysis.

Simple experiment on bees

The experimental process is schematized in Fig. 1. It consists in counting the bees coming into and out of the hive, moving either on the left part or on the right part on the hive entrance. The middle of that entrance must thus be marked (with a pencil or a pen), and if the entrance is very narrow, a larger artificial one should be built and tied to the initial entrance. The counting must be made during a given time period (see below) at the same time for the left and the right part of the entrance. Two persons can of course work together for obtaining these counts. The counting time must be determined according to the traffic of the bees: a minimum of 10 bees should be seen entering or leaving the hive, through the left or the right part of the entrance. If the traffic is important, the counting time period could be short (i.e. a few minutes); if the traffic is weak, the counting should be appropriately longer (i.e. 10, 15, or 20 minutes). The counting must be performed at least three times, exactly in the same way, during the same time period (for comparative purpose). First, a control must be made in a normal situation, i.e. without any wireless apparatus in front of the entrance. This provides the control numbers. Then a first experiment is proposed. A just switched on and activated mobile phone must be set on the left of the hive entrance, and a counting session must be realized in the same way as the control one. After that, a second experiment should be made. The mobile phone previously used must be again just switched on and activated, and then set on the right of the hive entrance, and a counting must again take place at that moment. Later on, after the bees have recovered, a third and a fourth observations should advantageously be made with the mobile phone set on the left (experiment III) and the right (experiment IV) of the entrance,

but this time, the battery of the phone must have been removed. A switched off mobile phone is still active, less than when switched on, but still operational (it can receive messages, for instance). To be inert, a mobile phone must thus be opened and its battery removed.

The different recorded numbers of bees (i.e. those of bees entering and leaving the hive during each counting session, through the left and the right parts of the hive entrance, without the phone or with it, on or inert) could then be compared. You are invited to send us these recorded numbers. After having received enough results, we intend to present them in a short paper.

Information to collect on EMF and hives' health

The information should be collected, written and sent as briefly shown in Table 1. It takes only a few minutes. First, assess the intensity of the electromagnetic field surrounding the hives. Either use an adequate apparatus (a magnetometer), or ask to a qualified person for making the required assessment. The intensity of the electromagnetic field can be exactly assessed (if stable, if an exact measure can easily be done, in V/m or W/m^2 or mW/cm^2), or can be evaluated (if the intensity varies between low and high values). In the latter case, you estimate that the intensity of the EMF equals 1, 2, 3, 4, and 5 when its value varies between 2 and 40, 50 and 100, 110 and 300, 400 and 1,000, 1,200 and 3,000 mW/cm^2, respectively. The result of this measure or evaluation should be written in the first column of a table. In the second column, furnish information on the hive's health. Write an index, equaling respectively 5, 4, 3, 2, or 1 when the state of health of the hives located in the measured electromagnetic field is excellent with no abnormal decrease of bees (5), good with only some slight decrease of the population (4), not very good with an obvious decrease of the population (3), rather bad with a large decrease of the population (2), and catastrophic if nearly all, or all the population disappeared (1).

Send us your two assessments (by mail). The collected information will allow examining the correlation between the intensity of the electromagnetic field surrounding bees' hives and the state of health of these bees. After having collected enough information for making a valuable analysis, we intend to relate the result in a short paper, together with the analysis of the here above experiment concerning the effect of a wireless apparatus.

Discussion, Conclusion

Among the numerous causes of the bees' CCD, their recent spectacular decline, there is one cause scarcely taken into account: manmade electromagnetism. Bees are very sensitive to electromagnetism, and finally, if you take attention to nature and compare its state with that existing 30 years ago, bees reflect a general problem, the decrease or bad health of insects, birds, plants among others. Contrary to pesticides, insecticides, decrease of the flowers diversity, parasites, predators and so on, the effects

of electromagnetism is not often evoked for explaining this alarming state of the nature, and that of the bees among others. There are two human reasons for this. First, most of humans can no longer live without the wireless technology: most apparatus used by humans depend on that technology and have now become indispensable; humans thus nowadays absolutely need wireless devices and technology. Secondly, a lot of persons earn their money, have a professional situation, and can efficiently work using this technology. As a matter of fact, nobody can now imagine a world without wireless technology. However, it is evidence: this wonderful technology may imperil nature, and consequently humanity.

The first objective of the present paper is to estimate to which extent bees are affected by electromagnetism (demonstrating at the same time that nature is affected). Its second, most important aim is to tempt ameliorating the situation of the bees. Indeed, if the impact of electromagnetism on bees' health is demonstrated thanks to a large amount of collected information, then hives could be located in places where the electromagnetism has a very low intensity, and even, could be set inside a kind of Faraday cage or enclosure. This could put a brake on the bees' CCD.

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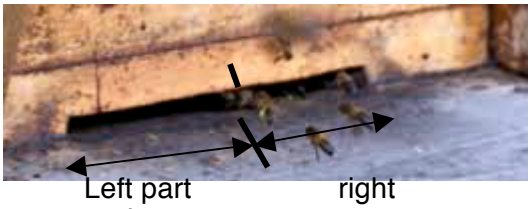


the middle must be marked; if the entrance is narrow, a broader one must be tied to it.

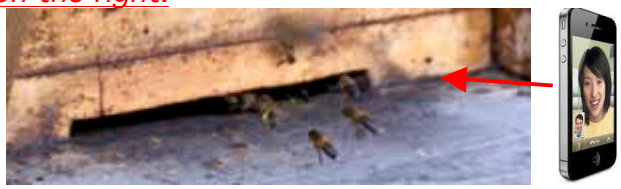
Control:

Count during a given time period the bees entering and leaving the hive through the left part and the right part of the entrance. You obtain two control numbers, one for the left and one for the right.

Experiment I – GSM on the left:

Set a just switched on GSM on the left of the entrance, the bottom of the GSM turned towards the entrance. Count the bees entering and leaving the hive through the left and the right parts of the entrance, during the same time period, exactly as while performing the control. You obtain two experimental numbers, one for the left + telephone on, one for the right without telephone.

Experiment II – GSM on the right:



Set a just switched on GSM on the right of the entrance, the bottom of the GSM turned towards the entrance. Count the bees entering and leaving the hive through the left and the right parts of the entrance, during the same time period, exactly as while performing the control. You obtained two other experimental numbers, one for the left without telephone, one for the right + telephone on.

If possible, repeat experiments I and II with the GSM deprived of its battery (you switch off the GSM; open it and take its battery away).You could so obtain numbers for the left + telephone inert and the right without telephone, as well as for the left without telephone and the right + telephone inert.

Results

The results can be presented, or not, in a table such as:

Experimental conditions	Left part	Right part
Without telephone	control, exp. II, IV	control, exp. I, III
With telephone on	exp. I	exp. II
With telephone inert	exp. III	exp. IV

Please, *send your results to*: mccammaerts@gmail.com

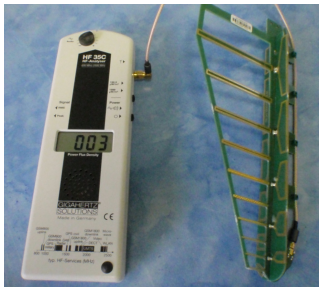
The numbers obtained without telephone will be compared to those obtained with telephone (to evaluate potential immediate GSM effects), and with telephone inert (to evaluate potential effects of an inert object at the entrance).

Figure 1: Schematic presentation of a simple experiment allowing revealing bees' avoidance of EMF. Details are given in the text.

Table 1: Inventory of the state of health of bees and of the surrounding electromagnetic field. Two assessments should be done, one of the EMF intensity (an exact measure or an evaluation), the other one of the state of health of the bees (an evaluation). These assessments, written for example in a table, should be sent to the author.

Relation between EMF intensity and general state of health of the bees

Measure or estimate the intensity of the electromagnetic field around and/or in the vicinity of the hives (where bees are accustomed to fly). Give a precise measure in EM units, or estimate the intensity: **1** = very low (2 – 40), **2** = low (50 – 100), **3** = moderate (110 – 300), **4** = rather high (400 – 1,000), **5** = very high (1,200 – 3,000).



Evaluate the state of health of the bees: **5** = excellent (= no abnormal decrease of bees), **4** = good (some slight decrease of the population), **3** = not very good (obvious decrease of the population), **2** = rather bad (large decrease of the population), **1** = catastrophic (nearly entire vanishing of the population).

You can write these assessments or evaluations in a table such as the here below one.

Intensity of EMF in EM units, or evaluated from 1 to 5	State of health evaluated from 5 to 1

Please, *send your results to*: mccammaerts@gmail.com