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INSECTS ARE DISAPPEARING ALL OVER THE WORLD.
THE CAUSE IS NOT KNOWN.
OR IS IT?

PAPER VERSION OF LECTURE HELD AT LITTERATURHUSET, OSLO.

AT THE SEMINAR

5G OG VÅR TRÅDLØSE VIRKELIGHET - HØYT SPILL MED HELSE OG MILJØ

ARRANGED BY Z-FORLAG AND EINAR FLYDAL

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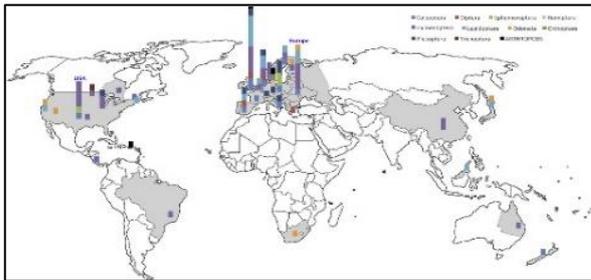


Hi, I'm The Insect Inspector, a citizen scientist worried about the small things and why flying insects are disappearing. I grew up on a farm. On summer nights, I would open the window, turn on the light and watch the ceiling fill up with a cloud of insects. Over the years, I opened the same window and watched species disappear.

No bugs in the bedroom is good for people who don't like insects. But their disappearance has gone un-noticed. Look at spider webs. They used to be a world of struggle and murder and are now just empty traps. Also, on an early evening drive a vast number of insects would splatter on the windscreen. Now there are hardly any.

Global Decline

A recent study of all the research available reported a big drop in numbers world-wide. Current data shows over 40% of species are declining and a third are endangered (1).



"If insect species losses cannot be halted, this will have catastrophic consequences for both the planet's ecosystems and for the survival of mankind,"

Unknown Factor

It is usually pesticides, habitat loss, climate change and artificial light that are to blame. No doubt these are major factors. However, a report from a survey conducted over 27 years by the Krefeld Entomological Society shows flying insect biomass has dropped by 75% in a generation. The report, based on a science-based methodology, says something else is adding to this, but they don't know what it is (2).



*The decline is apparent regardless of habitat type, changes in weather and land use. There is an urgent need to uncover the cause of this decline.
Krefeld Entomological Society*

Realistic Hypothesis

To identify the missing link and explain the unaccountable loss, I propose that: -

Human-made electromagnetic radiation (EMR) is a factor in the global decline of flying insects.

More precisely, many insects are severely affected by the unintended consequences of human-made (anthropogenic) EMR in the 300 MHz to 300 GHz microwave bands – mainly by the frequencies used by the civil and military mobile device and phone networks around the world.

The Law of Unintended Consequences states: "Interfering with complex systems tends to create unanticipated outcomes".



Non-specific magnetic fields	Static magnetic field Extremely low frequencies (< 1 kHz)
Non-specific electric fields	Static electric field Extremely low frequencies (< 1 kHz)
Non-specific radiofrequencies	Between 1 kHz - 6 GHz
Non-specific microwaves	Between 6 GHz - 300 GHz
Non-specific infrared	Between 300 GHz - 430 THz
Application-specific exposure	Power lines magnetic field (50 or 60 Hz)
	Power lines electric field (50 or 60 Hz)
	Analog broadcasting-like signals (TV, radio)
	Digital broadcasting-like signals (TV, radio)
	2G base station-like signals (GSM)
	3G base station-like signals (UMTS)
	4G base station-like signals
	Radar-like signals

A Simple Connection

I came up with the hypothesis while trying to save a starving Chameleon in The Gambia. I couldn't find any crickets to feed it. A local resident said that since a wireless base station mast had been erected, crickets had vanished. A dictator ran the country at the time. I found out that the mast power output was much than allowed in Europe. In that part of West Africa pesticides are costly and hardly used. The habitat is stable, artificial light is not to blame, and the rural economy is based on subsistence farming. Since I had a career in computing behind me and having a basic understanding of wireless technology, I set about researching if there could be such a connection.



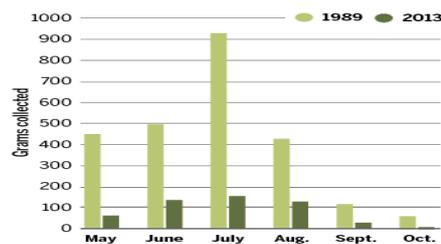
Impact Statement

If my hypothesis is correct it is important, not just because of what is happening now but because of the planned deployment of 5G infrastructure. 5G will make things worse as the new network needs to cover 95% of land mass to work at its full potential. Today, networks cover 25%, according to the best guess (about 57% of land mass in uninhabitable land).



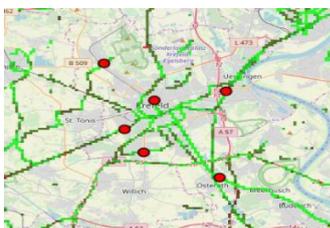
The Effect

Krefeld Entomological Society surveys nature reserves in Germany close to the Belgium and Dutch borders. Its findings are accepted as reliable. As all the other indicators of insect decline are factored in the report, I used the data as my benchmark (3).



The Cause

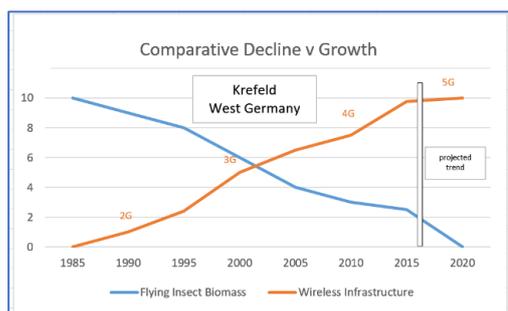
I plotted the trend of insect decline from the Kerfeld survey (see graph) and then mapped the growth of mobile networks in the area over the same time (see three maps, for the period 1995 - 2016). Data from a wireless industry source shows three generations of mobile communication infrastructure expanding to improve coverage and deliver greater bandwidth (4).



The growth of GSM - G3 - G4 wireless base stations around Krefeld between 1995 - 2016

Obvious Correlation

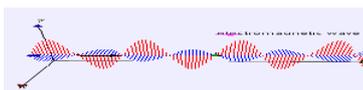
When the data sets were overlaid, there was a clear correlation between the decline of insects and the increase in EMR coverage. Also, the Krefeld study found that none of the usual causes could explain the decline. It therefore seems probable that the microwaves could be the cause.



However, correlation does not mean causation. There must be a causal link. Let me set-out the evidence of how human-made EMR can affect the wellbeing of insects to establish the causal link.

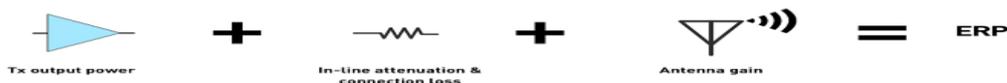
Causal Link

To see if there is a causal link, I looked for any biological effects of human-made EMR. I examined for peer-reviewed scientific papers where microwaves (used as high-frequency radio waves) were linked to insect well-being.



Power Tests

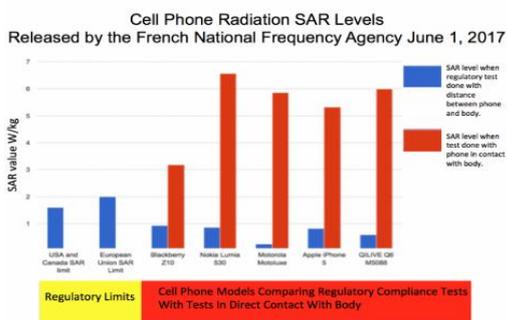
The first paper reviewed was published in 2018. It was a repeat of a much earlier experiment where microwaves were tried out as a control mechanism for insect infestations in stored food, like wheat and barley. The system was designed to damage insects but not the grain. Generating an effective radiated power (ERP) output of between 200 – 500 watts at 2.45Ghz, microwaves first damaged eggs, then larvae, followed by pupae and adults. As power levels rose, mortality increased (5). Both trials proved that EMR impacts the whole life cycle of insects. For reference, a home Wi-Fi router produces up to 4 watts ERP at the same frequency.



The Dose makes the Poison

Do negative effects occur at much lower power levels and at other frequencies? In a paper published by the Royal Society in 2019, it was shown that very weak broadband RF interferes with the circadian rhythm (internal clock) of the German cockroach. Interesting though that is, what is more striking, is that the field strength needed to disrupt the process was an extremely small amount of energy in the nanotesla range – a measure of magnetic induction (6). These experiments show that some radio frequencies are both strong enough to kill and weak enough to harm insects.

Extensive Research



Safety Guidelines – who to trust?

Mobile operators are responsible for ensuring that emissions from their networks meet industry guidelines (27).

Independent smartphone radiation tests found some popular smartphones have higher emissions than admitted (28).

What other evidence is there? And why are there gaps in our understanding? Firstly, there is little research and comparative data from earlier times. Secondly, people who study insects are themselves an endangered species, and thirdly, insects are hard to study. However, ants and fruit flies are model organisms. Studies show that EMR affects ants' sense of orientation. And, in the case of fruit flies exposed to low-level radiation from a mobile phone during the first days of adulthood, EMR reduced their reproductive capacity by half (8).



Low level radiation includes; Bluetooth, Wi-Fi, cordless phone base stations and baby monitors.

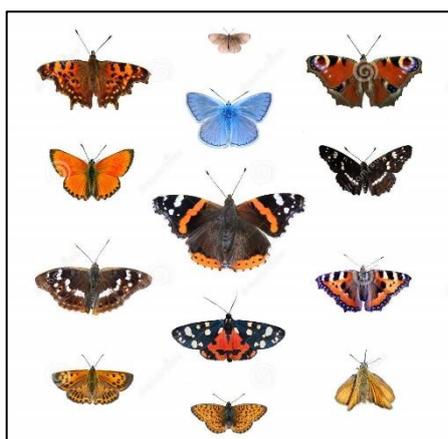
Case Studies and Causation



Over 50 scientific papers link biological changes in insects from low-level exposure to EMR affecting:

- Growth & Development
- Fertility & Reproduction
- Behaviour & Stress
- Mutation & Mortality

- In one study, exposing fruit flies to mobile phone radiation showed high stress protein levels (7).
- A long-term observation of laboratory ants proved electromagnetic waves affected their pheromone response and the skill to get hold of food (9).
- Research in South Africa found a link between the decrease in ant and beetle diversity and EMR exposure close to mobile phone masts (10).
- In one experiment, the pupae of the mealworm beetle were irradiated. The result was a rise in the number of abnormalities (11).
- In 2017, German students studied bee behavior and found that EMR made them more aggressive and disorientated (12).
- In field trials on Greek Islands, EMR values were compared with insect numbers. It found that pollinators which lived and bred underground fared better than those that lived and bred above ground. This altered the balance of populations; some declined, and a few grew. The only group unaffected, were butterflies - the one insect everyone likes (13).

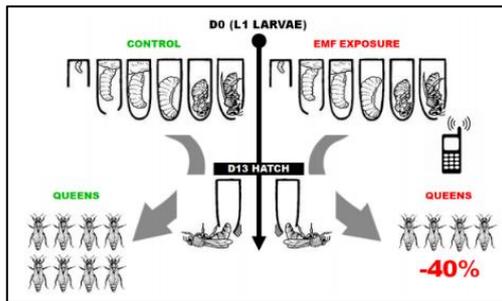


Enough good science states that EMR negatively effects insects

- **Mobility** - EMR disrupts geomagnetic orientation through the effect on Cryptochrome, a photosensitive protein vital in the detection of magnetic fields by fruit flies and other insects (21).
- **Perception** – Some insect's antennae are sensitive to interference from radio waves (18) .
- **Structure** - Certain insect body parts are semiconductors that respond to the EMR (19).

Empirical Evidence

These few examples show how EMR impacts a variety of insects' ability to feed, breed and pollinate. There is a growing file of evidence showing this harm happens at all phases of their life cycle. EMR is particularly damaging at the egg and larvae stage. This may well explain their reduced numbers. Many of the experiments are done in the lab. The work is complex, often underfunded and therefore difficult to replicate. It is the lack of repeated experiments that make the findings exposed to debate.



Vulnerable when Young

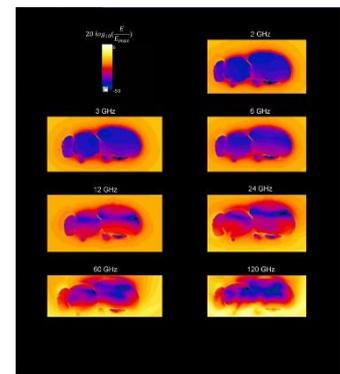
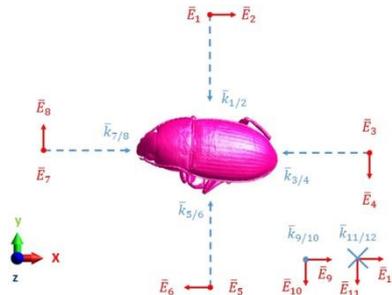
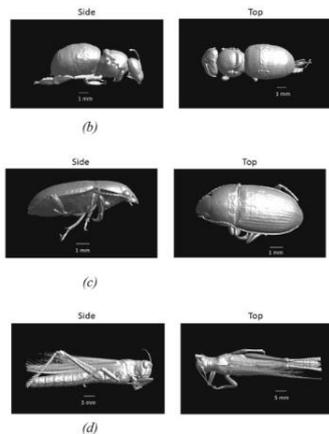
Insect eggs take between a day to several months to hatch.

They are at most vulnerable when developing in beams of radiation (25).

Eggs and larvae are safest underground.

Virtual Simulations

A helpful document was published in 2018. It details how computer-modelled insects reacted when subjected to EMR. The research team analysed the amount of RF power absorbed over a range of frequencies. The findings showed the greatest absorption is when wavelength and body size are equal. The most significant increase in absorption of energy was at 6GHz and above. Resonating between 1 & 10 mm this is right in the 5G FR2 spectrum (13).



Images reproduced under the Creative Commons license with credit to Arno Thielens, Duncan Bell, David B. Mortimore, Mark K. Greco, Luc Martens, and Wout Joseph (13)

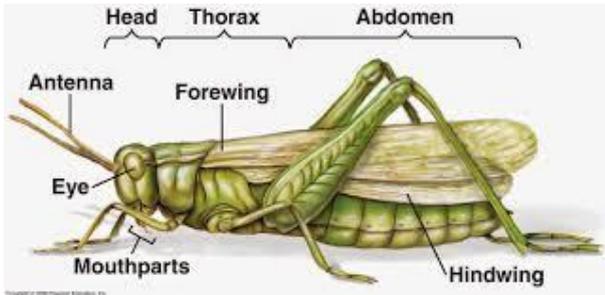
Environmental Impact

Microwaves cause water molecules to move. It means any living tissue absorbs EMR energy as heat -- a process called dielectric heating. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) sets EMR levels solely on the detectable heating of tissue (SARS). Its 30-year-old guidelines (adopted by the wireless industry) does not consider any other biological impacts. I asked ICNIRP if any research exists about the impact on insects. It has not undertaken any and does not plan to.

The wireless industry conducts one form of testing. It tests how much radiation is absorbed by a bag of saline fluid to determine the specific absorption rate (SAR) and ensure extreme heating would not occur. No research is done on people as what they know about EMR from animal studies would render it unethical.

Direct Effects

When an insect's body part and an energy wave match in length, there will be a coupling or impedance matching, like a radio transmitter and receiver designed for good signal transfer. With certain 5G FR2 band frequencies (~20Ghz) there will be a very strong coupling to insect body structures at a one-to-one ratio (15). This will have huge consequences: Lots of bugs have an exoskeleton with watery, fatty guts. With frequencies resonating at billions of times per second, insects, that usually manage to regulate temperature, will heat-up over their thermal limit. If any of insect parts are damaged by heat or by non-thermal shock, they are finished.

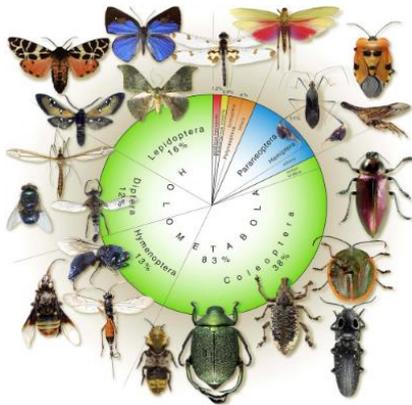


Exposure to EMR can result in

- widespread effects on the brain, neurons, developing cells and enzyme systems.
- sharp changes in the various enzymes systems of fat body and hematological profile (30).

Case Proved

This hypothesis began with an educated guess. I investigated the facts and have presented evidence that underpins it. It relies on the premise that there is an unknown cause of insect decline apart from mainstream reasons. I followed the scientific method and applied a good dose of scepticism. I have tried to destroy the hypothesis, knowing there is one way to the right answer, but an infinite number of ways to go wrong, but I can't. It continues to stand. Invisible though it is, human-made EMR is now part of the environment. So, I offer up human-made electromagnetic radiation as the villain of the piece in this inquiry.



Answer tested against Hill's criteria (29)

- Strength
- Consistency
- Specificity
- Temporality
- Biological gradient
- Plausibility
- Coherence
- Analogy

Ignoring the lessons from the tobacco, asbestos and other industries failure to admit to known side-effects, many governments are only too happy to make billions from selling bandwidth. And, despite the recent diesel emissions scandal, they do not conduct normal safety testing. The UN-funded studies on pollinator decline, whatever the pleas from independent scientists, ignore EMR as even a remote option. In 2018, an EU funded Eklipse study (one that found links) called for urgent research into the area. To date none has been commissioned. With everything on the planet now part of an untested experiment, there seems little political will to evoke the Precautionary Principle and find the answer (14).

The Precautionary Principle

“When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm”.

Conclusion

In some area's insects have nearly vanished, but sceptics tell me of cities where there are plenty of mosquitoes and lots of EMR. Others say that their house is full of both crane flies and Wi-Fi. Someone asked if there is a formula for insect death - like four dead for every tweet. There is no such formula, no fixed pattern. The insect world is so varied. The only thing they have in common is their decline. This argument is that their decline toward extinction is from an invisible force more overlooked than unknown.

Insects are like the canary in a coal mine. When it stopped singing, miners knew it was time to run. I grew up in the country with the buzz of insects all around me. The buzz about 5G will be short lived if insects disappear, as now there is nowhere to run.



*"We can no longer say
that we did not know".*

Executive Secretary
The Intergovernmental
Science-Policy Platform on
Biodiversity and Ecosystem
Services



Postscript

However, all is not doom and gloom. Around the world there are lots of individual, institutions and pressure groups acting to halt, disrupt and legally bind the wireless industry from inflicting a calamity on the environment and a digital tyranny upon us. I urge you all to spread the word.

Written and presented by Michael Chapman Pincher - AKA the Insect Inspector.

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Michael Chapman Pincher is the son of a famous investigative journalist and zoologist. He grew up in a house where a connection to nature and an understanding of power went together. As a journalist, Michael wrote about the emerging IT market at the introduction of the PC and has kept up to speed with development in ICT. Moving from writing about technology to consulting to the big IT giants, Michael toured Europe telling people that the Internet was coming. As a communicator, he bridged the gap between the technical and business world, sitting on several boards to lobby for and justify the funds required for big projects. He retired after working as Head of Information Systems on Crossrail, Europe's largest Infrastructure Project.

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