Emerging Environmental Pollutants: Neonicotinoid Insecticides and their Toxicity Towards Non-Target Organisms

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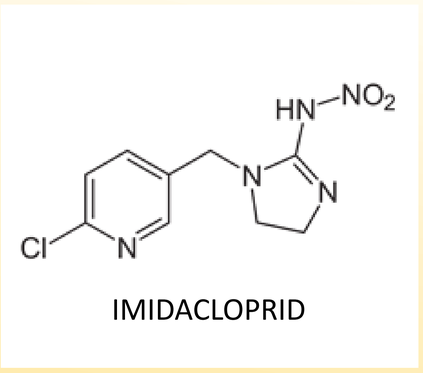
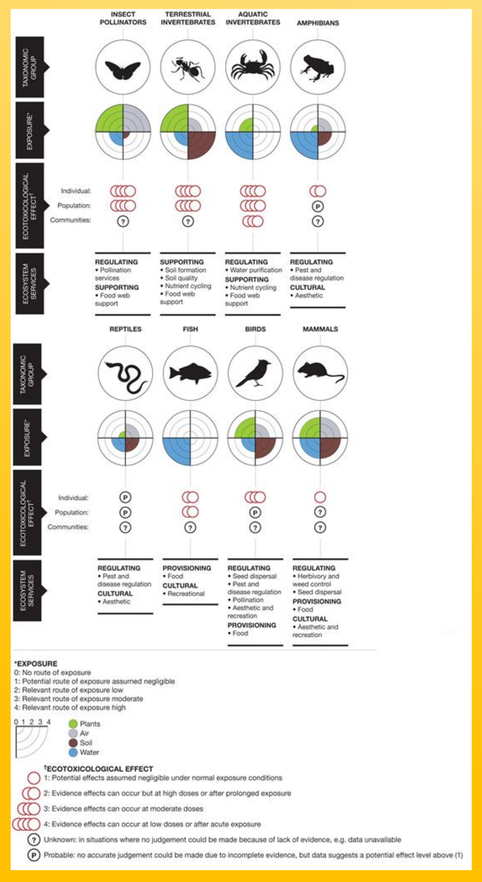
WHAT ARE NEONICOTINOIDS?

Neonicotinoid insecticides are the most widely used pesticides worldwide. Their chemical structure derives from that of nicotine. Imidacloprid is the first neonicotinoid launched on the market in 1991. Due to their extensive use, neonicotinoids have become ubiquitous environmental pollutants. These systemic insecticides are extremely efficient against plant pests and present many advantages compared to other insecticides, such as low cost, persistency, low molecular weight, high water solubility, low bioaccumulation potential and wide versatility of application.



IMIDACLOPRID



TOXICITY

Neonicotinoids are extremely toxic towards target organisms but due to their extensive use, thousands of cases of resistance in pests have already been reported. Moreover, concerns have been raised about their environmental burden, therefore their impact on non-target organisms, biodiversity, and ecosystems. Concerning the toxicity of neonicotinoids towards non-target organisms:

1) Beneficial terrestrial invertebrates in agricultural lands and in the surrounding vegetation are the most affected. As well as aquatic invertebrates living in the irrigation channels, streams, rivers, wetlands, and farmlands near or receiving runoffs from agriculture.

2) The studies conducted on the toxicity towards humans are limited and sporadic. As a matter of fact, humans are exposed to increasing doses of neonicotinoids in their daily life though the environment, the food web and antiparasitic pet collars. Some concerning issues are arising.

3) It is largely confirmed that neonicotinoids are highly toxic towards pollinating insects. For the four species of bees that have been studied, it has been confirmed that neonicotinoids can cause alterations in the sense of smell and memory, reduced reproductive success, reduced foraging, less frequent return to the hive, learning disabilities, and weakening of the immune system.

LEGISLATION

Neonicotinoids are not yet consistently regulated worldwide. Only the USA, Canada and the EU have applied restrictions on their use. At the moment, in the EU, neonicotinoids usage outdoors in banned (but it remains possible in green houses). However, in case of emergency, the member states can issue emergency authorizations for their use.

"WHAT THE PUBLIC IS CALLED TO ACCEPT TODAY AS SAFE COULD PROVE EXTREMELY DANGEROUS TOMORROW" – Rachel Carson

Neonicotinoids have a great economic value; they are undoubtedly useful for saving crops whose value would become zero or decrease a lot due to the infestation of harmful insects. On the other hand, studies indicate that neonicotinoids can harm non-target organisms, including humans. Considering that we will have to live together with these insecticides for a long time, preventive applications should be avoided, while using them only when strictly necessary. For this reason, it is essential to implement the regulation on their use all over the world. Furthermore, additional research providing a detailed understanding of their activity, toxicity and environmental impact is needed in order to ensure both ecological safety and the maintenance of human health.

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