

MAJOR POINTS ON FLUORINATED PESTICIDES from
Revisiting pesticide pollution: The case of fluorinated pesticides.
Diogo A.M. Alexandrino et al (2021) Environmental Pollution. Oct. 2021
(compiled by S.Knight)

- ~ In the 21st century, organofluorine pesticides account for more than half of pesticides registered between 2010 and 2020. They use the combination of fluorine and carbon, an extremely strong chemical bond.
- ~ From 2015 to 2020, 70% of pesticides registered were fluorinated pesticides.
- ~ Insecticides fipronil and lambda-cyhalothrin, fungicides epoxiconazole and trifloxystrobin rank among best selling pesticides for the last 20 years world-wide.
- ~ Combining a carbon molecule with fluorine provides strong adherence to and penetration of living tissue, especially fatty tissues (lipophilicity), provides prolonged chemical stability in organisms and residual activity in living tissue.
- ~ Some pesticide manufacturers are adding fluorine to existing pesticides to prevent resistance to pesticides. Some diamide insecticides were fluorinated for this reason.
- ~ The positive effects that fluorine contributes to pesticides' ability to control pests may also intensify their environmental impact, because those effects can cause the *emergence of highly stable molecules with a large potential to inflict ecosystem damage*, due to their persistence, bioaccumulation potential and ecotoxicological effects..
- ~ Some of the pesticides launched since 2010 also correspond to the most persistent pesticides among the listed compounds, such as pydiflumetofen (DT50 of 2416 days), bixafen (DT50 of 500 days), flubendiamide (DT50 of 500 days), isoflucypram (DT50 of 318.5 days), mefentrifluconazole (DT50 of 268 days) or fluxapyroxad (DT50 of 183 days) ([Tables 1 and 3](#)) ([Lewis et al., 2016](#)). (Mefentrifluconazole is used on VT golf courses.
NOTE: DT50 means the half-life or the number of days needed for ½ of the compound to break down, depending on many variables.
- ~ Scientists observed “bioaccumulation of fluorinated pesticides in honeybees, alongside other types of pesticides, and events of mass mortality of colonies of these insects in Italy.”
- ~ The authors found a wide array of different fluorinated pesticides bioaccumulated in dead honeybees, including fludioxonil, fluopicolide, fluopyram, flutriafol, tefluthrin, trifloxy-strobin and fipronil, in amounts as high as 140 ng per bee ([Martinello et al., 2020](#)).”
(NOTE: fludioxonil, trifloxystrobin, and fipronil are used in Vermont.)

~ “Pyrethroids, including the fluorinated congeners λ -cyhalothrin, cyfluthrin, bifenthrin and fluvalinate, have also been widely implicated in bioaccumulation phenomena in aquatic and terrestrial organisms *as well as in humans, including babies exposed through lactancy.*” (emphasis added)

~ Organofluorines are attracted to carbon in highly organic soils, rendering them more likely to “trigger a series of ecotoxicological events that can lead to serious ecological impacts in terrestrial and aquatic ecosystems.”

~ “Fluorinated pesticides are more liable to adsorb to plastic fragments of varying sizes, which may grant them a higher environmental mobility and contribute to their persistence.”

~ [Certain groups of] fluorinated pesticides target *key enzymes that are present in most living organisms*, thus expanding the range of sensible species they may negatively affect by *impairing central physiological processes in these non-target organisms.*”

~ Scientists have highlighted the potential of various fluorinated pesticides, such as fipronil, trifluralin or epoxiconazole, and others to act as *endocrine disrupting, genotoxic and immune suppressing agents* after *acute and chronic exposures of terrestrial and aquatic organisms.* (emphasis added.)

~ “The occurrence and distribution of fluorinated pesticides is not restricted to their expected environmental sources (e.g., agriculture fields, pesticide factories) and, in many cases, may endure for prolonged periods of time after their initial introduction in the environment.”

~ “*While it is a fact that some fluoroorganic pesticides are liable to biodegradation, it is also true that their microbial catabolism (process of breaking down organic molecules) is highly redundant and unproductive, often involving incomplete biodegradation processes that yield complex (often still fluorinated) sub-products, many of which may still hold potential for non-target toxicity.*” (emphasis added)

“These pesticides display a set of features that can turn them into aggressive environmental pollutants which, combined with their widespread environmental distribution, forecast an array of impacts at the ecosystem level.”

Table 1 (p.2) lists 24 fluorinated pesticides, IUPAC name, type, target crop, octanol-water partition coefficient (LogP) and manufacturer.

Table 3 (pp 4-5) lists 20 fluorinated pesticides, their molecular structure, type, year of launch, half-life, octanol-water partition coefficient (LogP), manufacturer and reference.