Mini-review highlighting toxic effects of Triflumuron in insects and mammalian systems

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Introduction

Triflumuron (TFM) is a benzoyl phenyl urea insecticide belonging to the class of IGRs. TFM is widely used around the world to increase crop yield by protecting them from damage caused by insects. TFM works by inhibiting the synthesis of chitin, an essential part of the insect cuticle, making it susceptible to pathogens and deformities. However, studies revealing its toxicity and its mode of action in mammalian systems remain very limited. The aim of this review is to better inform the community about the impact of TFM on crops, the environment, and human beings by summarizing its toxic effects.

1- TFM uses

TFM is used to protect crops (apples, tomatoes, fruits, vegetables, forest trees, and cotton) and domestic animals (horses, sheep, and chickens) against a broad spectrum of pests. However, TFM also causes collateral damages which include serious health effects and environmental damage.

2- TFM exposure route

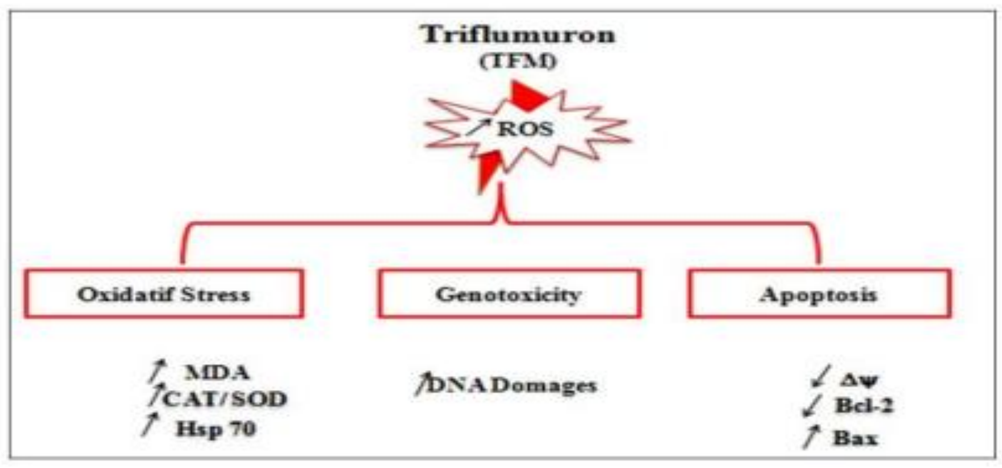
Human exposure to TFM is primarily through t h e ingestion of contaminated food with TFM residues detected in many crops such as tomatoes, apples, and frozen pears. When ingested, TFM can cause nausea, vomiting, and abdominal pain. Dermally, TFM penetrates the skin and could be the cause of serious skin changes such as stinging and itching. The pulmonary route represents also an important route because the products are transported rapidly to the blood via the pulmonary air. In fact, the product enters the lungs by inhaling contaminated air which results in respiratory disorders including headaches and dizziness

3- TFM Toxicokinetic

The oral route is the primary route of absorption for this insecticide (with a percentage ranging from 78 to 96%). The lowest levels of absorption are through the skin or by inhalation. Distributed preferably in adipose tissue, the maximum concentration in most organs (liver, kidney, lungs, spleen, intestines) and tissues remain in blood circulation between 8 and 72 hours after administration. However, the low amount of residue and the rapid excretion (89-95% in 48h via urine and feces) suggested that there is no bio-accumulation in the body. The major metabolic pathways include hydrolysis, conjugation, and/or hydroxylation, with up to 26 components identified in bile.

4- TFM mechanism of action

The figure below summarizes the results, showing the toxic impact of TFM in both human hepatic and spleen cells after their treatment with concentrations ranging from 50 µ M to 200 µ M . This toxicity essentially takes place via oxidative stress causing cytotoxic and genotoxic damages in both cell types tested. This cytotoxicity was elucidated by a dose-dependent decrease in cell viability, MDA production, Hsp 70 induction, and disruption of the antioxidant enzymatic cell defense system. In addition, genotoxicity was evidenced by the drop in mitochondrial transmembrane potential, disruption of the Bax / Bcl-2 balance, and ultimately DNA fragmentation leading to mitochondrial apoptosis. Additionally, this study indicated that liver cells were more sensitive to TFM exposure than renal cells,



Conclusion

All prior studies on TFM toxicity focused exclusively on insects. Our motivation for the current review to include both insects and mammalian systems was to broaden the understanding of TFM since its use is widespread worldwide, including here in Tunisia. It was known prior to our research that TFM toxicity in crops is harmful when consumed by farm animals. But our research also found that humans could experience liver and spleen cancer since we found evidence of hepatotoxicity and nephrotoxicity. Our focus in this research was the consumption of contaminated crops by humans, but toxicity is also passed to animals through their consumption of the crops. There are, obviously, policy implications that need to be considered.