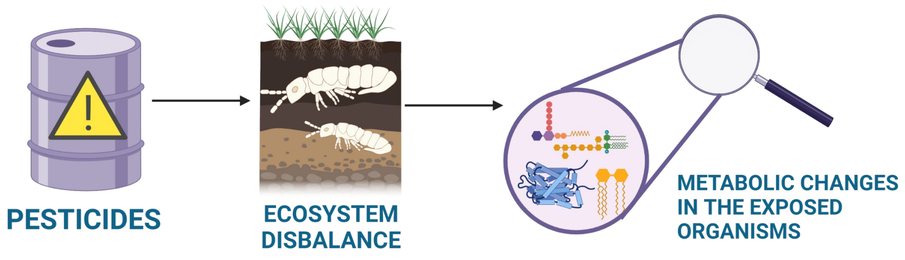
Low levels of Teflubenzuron disrupt **lipid metabolism in springtails**

Untargeted lipidomics to assess the response of the non-targeted species *Folsomia candida* to sub-lethal concentrations of Teflubenzuron

Diana Ilyaskina[1], Marissa Kateva[1], Saul Fernandes[2], Marja Lamoree[1], Pim Leonards[1]

Vrije Universiteit Amsterdam, Amsterdam Institute for Life and Environment (A-LIFE), 1 Section Environment and Health, 2 Section Animal Ecology

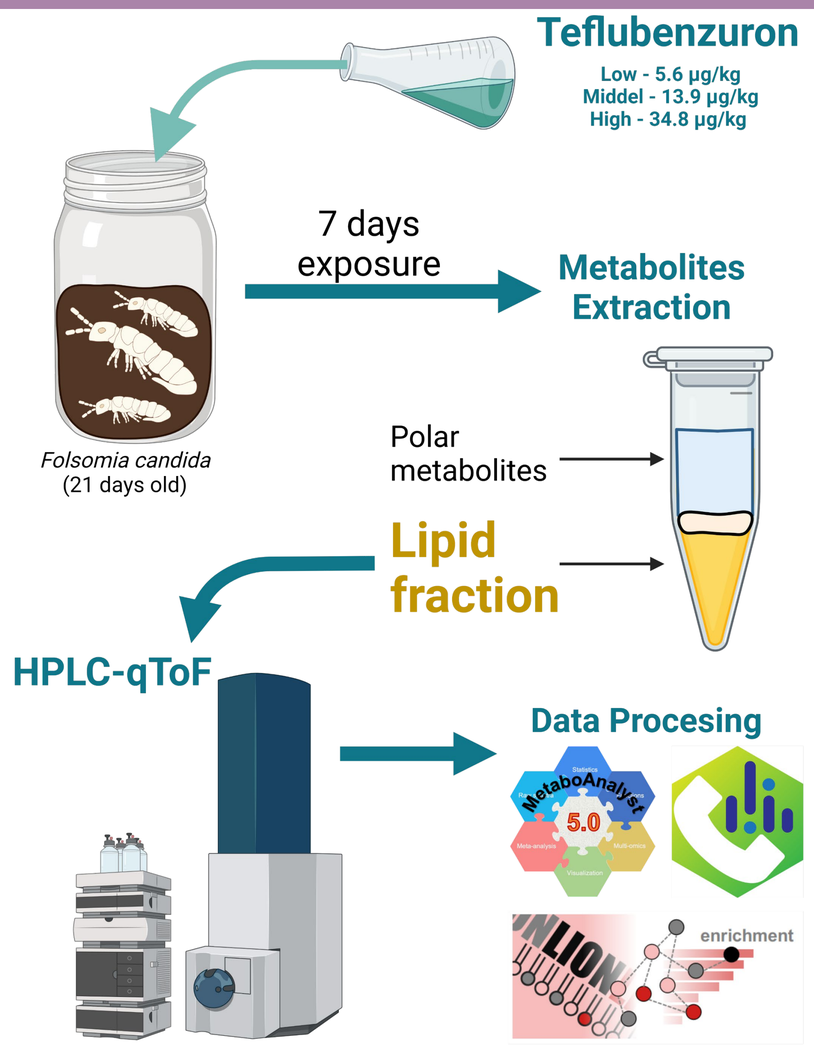
INTRODUCTION



Untargeted screening of metabolic changes in the organism provides a more detailed picture of the sub-lethal effects of chemicals present in low concentrations in the environment.

The aim of the study was using untargeted lipidomics to investigate potential toxicity side-effects of the insecticide Teflubenzuron on Folsomia candida exposed to environmentally relevant concentrations.

MATERIALS AND METHODS



RESULTS

- The major affected lipid classes due to exposure to TEF were:
  - Phospholipids (PC and PE)
  - Diacylglycerols (DG)
  - Triglycerols (TG)
  - Fatty acids (FA)
- PCA demonstrated the separation of control replicates with exposed groups.
  - The decrease of TGs in the organisms can be connected to the usage of stored lipids as an additional energy source to cope with toxic effects.

PCA plots exposure versus control groups. On the left - lipids that were detected with ESI +, on the right - with ESI -.

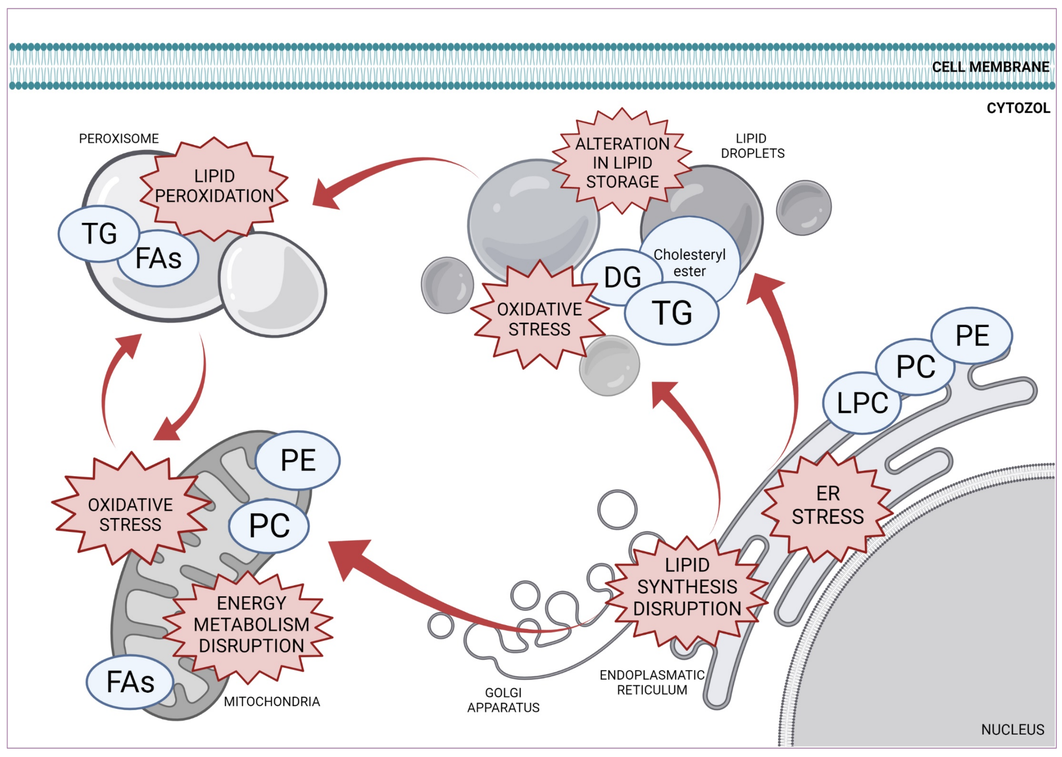
ESI +

Lipid classes	Annotated lipids	FDRq-value	ES	Regulation
Glycerolipids [TG,DG]	235	1.70E-30	-0.71	DOWN
Triacylglycerols[TG]	166	1.70E-30	-0.97	DOWN
Glycerophospholipids [PC,PE]	161	1.70E-30	0.642	UP
Steryl esters [CE]	3	5.87E-02	0.70	UP
Cellular compartment				
Lipid droplets [TG]	169	3.00E-30	-0.98	DOWN
Endoplasmatic reticulum (ER) [PC,PE]	161	3.00E-30	0.64	UP
Endosome/Lysosome [CE]	22	1.36E-09	0.68	UP

ESI -

Lipid classes	Annotated lipids	FDRq-value	ES	Regulation
Glycerophospholipids [PC,PE,PG]	126	5.50E-30	-0.68	DOWN
Fatty acids [FA]	58	1.47E-15	0.71	UP
Cellular compartment				
Mitochondrion [PE]	66	2.80E-15	-0.62	DOWN
Endoplasmatic reticulum (ER) [PC,PE]	112	4.80E-14	-0.57	UP

Enrichment analysis of lipid classes and their regulation in cellular compartments, for all exposure concentrations versus control.



Lipid metabolism network. The localisation of main detected lipids with untargeted lipidomics and associated adverse outcomes.

Red arrows reflect the interaction of lipid synthesis pathways and their influence on a sequence of adverse effects on molecular/cellular levels.

CONCLUSION

- **Teflubenzuron present in sub-lethal concentrations can cause significant effects on lipid metabolism.**
- **The main lipids dysregulated by Teflubenzuron were phospholipids, triglycerols, and fatty acids.**
- **The dysregulation of the lipids can cause malfunctions in lipid membrane synthesis, energy storage, oxidative stress (lipid peroxidation) and lipid metabolism.**

Find out more about me and my project

d.Ilyaskina@vu.nl

Acknowledgement - This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No. 859891.

**Some images created with BioRender*