

# Paracetamol toxicity by phytotesting with *Lepidium sativum*

Nataliia Tkachuk<sup>1,\*</sup>, Liubov Zelena<sup>2</sup><sup>1</sup>Department of Biology and Human Health, T.H. Shevchenko National University “Chernihiv Colehium”, Chernihiv, Ukraine<sup>2</sup>Department of Virus Reproduction of the Danylo Zabolotny Institute of Microbiology and Virology, NAS of Ukraine, Kyiv, Ukraine

\*nataliia.smykun@gmail.com; n.tkachuk@chnpu.edu.ua

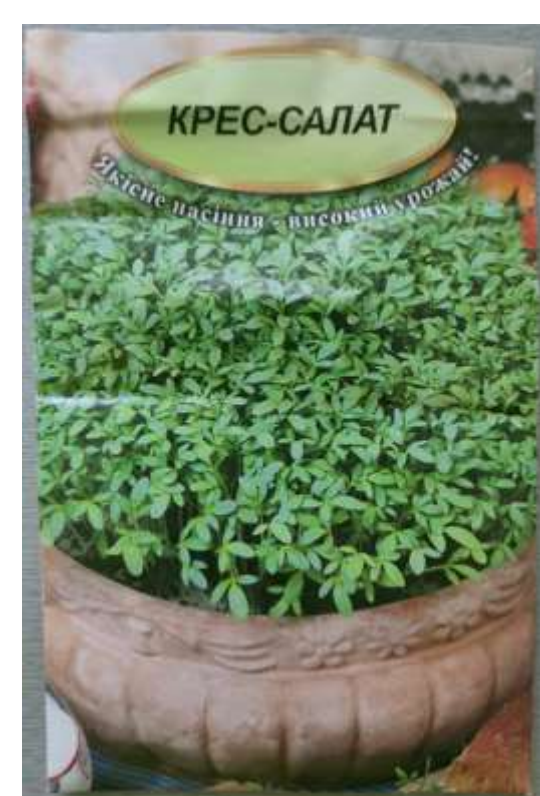
## INTRODUCTION & AIM

Pharmaceuticals are increasingly becoming environmental pollutants. For example, analgesics and antipyretics such as paracetamol (PCM) are found in soils, surface waters and wastewater (Al-Kaf et al., 2017; Doczekalska et al., 2025). Paracetamol is not persistent by nature and is therefore considered biodegradable in the environment (European Chemicals Agency, n.d.). The use of dicotyledon plants, known for their sensitivity to ecotoxins, as test plants helps expand the dataset on the agronomic effects and facilitates their evaluation. As far as could be determined there are no publications about the effect of PCM on *L. sativum*, and the research on the ecotoxicity of PCM for other higher plants is limited. Previous studies used pure paracetamol, not considering formulations with additional compounds. The aim of this study was to investigate of the impact of a paracetamol- and additive-containing pharmaceutical on growth characteristics of the seeds and seedlings of *Lepidium sativum* L., phytotoxicity and on microbial contamination of seeds.

## METHODS

### The growth test

#### Watercress (*L. sativum*)

Distilled water  
(variant P0)Infulgan solutions with different  
concentrations of paracetamol  
(variants P0.00001-P0.2)

**Figure 1.** Scheme of the experiment to study the toxicity of PCM-containing pharmaceutical to *L. sativum*

**Infulgan (used in intravenous infusion) contains** 10,000 mg/L PCM in a aqueous solution containing also the following additives in the formulation the percentage content of which is not indicated on the drug packaging: citric acid monohydrate, sodium citrate, sorbitol (E420) and anhydrous sodium sulfite (E221).

The germination energy (%) of the seeds of *L. sativum* (on the 3rd day), germination (%), biometric and morphometric indices of seedlings (length of roots and shoot) were evaluated on the 5th day from the start of the experiment; were calculated simplified vitality index (SVI) and relative root growth percentage (RRG, %).

## RESULTS & DISCUSSION

**Table 1.** Effects on watercress *Lepidium sativum* when using aqueous solutions of Infulgan with different concentrations of PCM, as compared to the control (100%) (Tkachuk & Zelena, in press)

Experiment variant	Germination energy, %	Germination, %	Root length, %	Shoot length, %	SVI, %	RRG, %
P <sub>0</sub>	100	100	100	100	100	—
P <sub>0.2</sub>	92.3±11.5	96.1±13.8	3.2±0.0*	0.0*	1.7±0.0*	3.2
P <sub>0.1</sub>	96.1±3.8	96.1±3.8	8.0±1.3*	33.1±3.4*	18.1±1.7*	8.0
P <sub>0.05</sub>	100	100	38.3±5.4*	84.1±10.9	58.1±7.6*	38.3
P <sub>0.025</sub>	80.0±10.0	80.0±10.0	64.2±6.7*	119.3±10.5	81.2±7.2	64.2
P <sub>0.002</sub>	84.5±10.2	84.5±10.2	68.7±15.0	92.9±17.6	66.9±13.3	68.7
P <sub>0.000025</sub>	107.2±0.0	107.2±0.0	102.8±5.9	98.9±3.9	109.1±5.5	102.8
P <sub>0.000001</sub>	107.2±0.0	107.2±0.0	110.7±4.0	103.4±3.1	116.6±3.4	110.7

**Note:** \* – The difference compared to the control is significant at  $p \leq 0.05$ . SVI = simplified vitality index; RRG = relative root growth

## CONCLUSION

The germination energy and seed germination rate did not change under the influence of PCM as formulated in the pharmaceutical Infulgan at any concentration tested, however, the biometric indices of seedlings changed significantly. The toxicity for *L. sativum* of Infulgan solutions, containing different amounts of PCM was found. When taking published PCM concentrations characteristic of wastewater into account, they appear not to pose a risk to the germination and growth of watercress at present. One should consider, however, the possibility of accumulation of harmful substances in the environment and the increase in the concentration, which defines further perspective of the studies of their impact on plants.

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