Evaluation of the toxicity of wet wipes based on the growth test with *Lepidium sativum* L.

Nataliia Tkachuk[1], Liubov Zelena[2]

[1]T.H. Shevchenko National University "Chernihiv Colehium",
Chernihiv, Ukraine, nataliia.smykun@gmail.com

[2]Kyiv National University of Technologies and Design,
Kyiv, Ukraine, zelenalyubov@gmail.com

- Hygienic products, in particular, wet wipes, occupy a significant share of everyday goods.
- Wet wipes contain various chemical compounds that can have a negative impact on the environment and human health, in particular, surface-active substances.
- The toxicity of chemical compounds and substrates is determined by biotesting methods, in particular for garden cress (*Lepidium sativum* L.).
- Since after use, wet wipes become garbage, enter the environment, in particular, the soil, accumulate there, they can become a source of dangerous compounds, therefore, it is advisable to investigate their toxic properties.
- The aim of this study was to investigate the toxicity of wet wipes according to the growth test with garden cress.

In the process of research preparation

Test plant seeds

Chemical compounds in the composition of wet wipes (according to manufacturer)

Surface-active substances are highlighted in red

Production of Ukraine

- **WW1** - demineralized water, glycerin, propylene glycol, benzalkonium chloride, cocamidopropyl betaine, PEG-40 hydrogenated castor oil, PPG-2 methyl ether, ethylparaben, 2-bromo-2-nitropropane-1,3-diol, cetrimonium bromide, extracts of sedum, chamomile, calendula, perfume composition, citric acid. Material of wipes: non-woven fabric (60% polyester, 40% viscose).
- **WW2** - demineralized water, glycerin, propylene glycol, benzalkonium chloride, cocamidopropyl betaine, PEG-40 hydrogenated castor oil, PPG-2 methyl ether, ethylparaben, 2-bromo-2-nitropropane-1,3-diol, cetrimonium bromide, flavor, citric acid. Material of wipes: non-woven fabric.
- **WW3** - water, flavor, citric acid, tocopheryl acetate (vitamin E), aloe vera extract, glycerin, allantoin, cocamidopropyl betaine, polypropylene glycol, phenoxyethanol, polysorbate-20, dehydroacetic acid, benzoic acid, tetrasodium EDTA, cetearyl isononanoate, ceteareth-12, ceteareth-20, cetearyl alcohol, glyceryl stearate, cetyl palmitate. Material of wipes: not specified.
- **WW4** - water, flavor, citric acid, tocopheryl acetate (vitamin E), sea buckthorn (*Hippophae rhamnoides*) extract, cranberry (*Vaccinium macrocarpon*) extract, glycerin, allantoin, cocamidopropyl betaine, polypropylene glycol, phenoxyethanol, polysorbate-20, dehydroacetic acid, benzoic acid, tetrasodium EDTA, cetearyl isononanoate, ceteareth-12 , ceteareth-20, cetearyl alcohol, glyceryl stearate, cetyl palmitate. Material of wipes: not specified.
- **WW5** - water, flavor, citric acid, tocopheryl acetate (vitamin E), aloe vera, sea buckthorn (*Hippophae rhamnoides*) extract, chamomile extract, glycerin, allantoin, cocamidopropyl betaine, polypropylene glycol, phenoxyethanol, polysorbate-20, dehydroacetic acid, benzoic acid, tetrasodium EDTA, cetearyl isononanoate, ceteareth-12, ceteareth-20, cetearyl alcohol, glyceryl stearate, cetyl palmitate. Material of wipes: not specified.

Chemical compounds in the composition of wet wipes (according to manufacturer)
Surface-active substances are highlighted in red

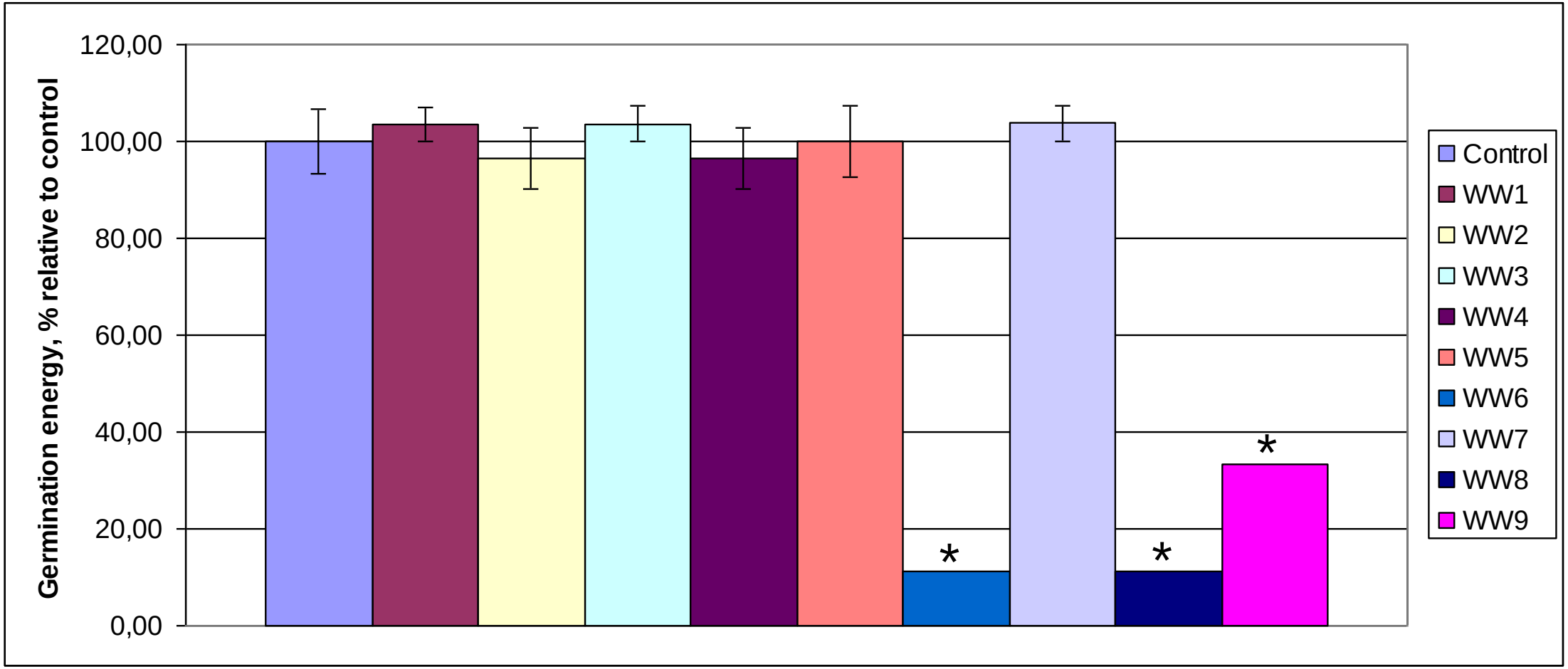
Production of Turkey

- **WW6** - do not contain alcohol and parabens; there are water, phenoxyethanol, perfume, benzoic acid, glycerin, tetrasodium EDTA, cetearyl isononanoate, cocamidopropyl betaine, dehydroacetic acid, ceteareth-20, cetearyl alcohol, glyceryl stearate, allantoin, panthenol, ceteareth-12, cetyl palmitate, chlorhexidine digluconate, D-limonene. Material of wipes: not specified.
- **WW7** - alcohol-free: deionized water, cetearyl isononanoate, ceteareth-20, cetostearyl, glyceryl stearate, glycerin, ceteareth-12, cetyl palmitate, polysorbate-20, phenoxyethanol, methylparaben, propylparaben, 2-bromo-2-nitropropane-1,3-diol, cocamidopropyl betaine, PEG-7 glyceryl cocoate, EDTA, citric acid, vitamin E, chamomile extract, perfume. Material of wipes: not specified.
- **WW8** - without alcohol and parabens; there are water, C12-15 pareth-12, phenoxyethanol, benzoic acid, dehydroacetic acid, glycerin, perfume, citric acid. Material of wipes: not specified.

Production of the United Kingdom of Great Britain and Northern Ireland

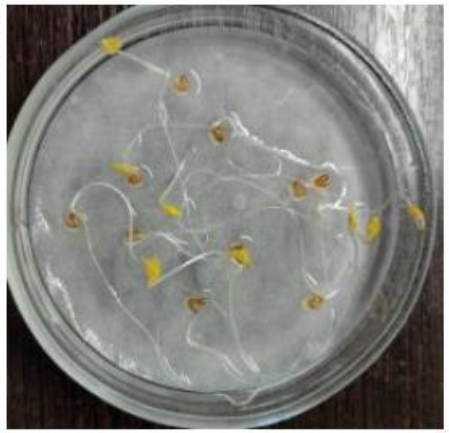
- **WW9** - water, polysorbate 20, caprylyl glycol, sodium benzoate, coco-betaine, maleic acid, sodium citrate. Material of wipes: 70% cellulose and 30% plastic (prevents tearing during use).

Germination energy, % relative to control



* - differences from the control are significant at $p \leq 0.05$

Research results (5 days)

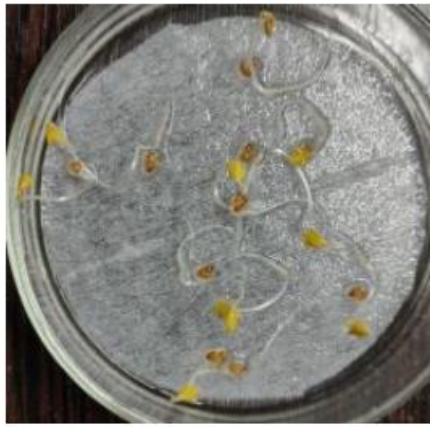


Control

WW1

WW2

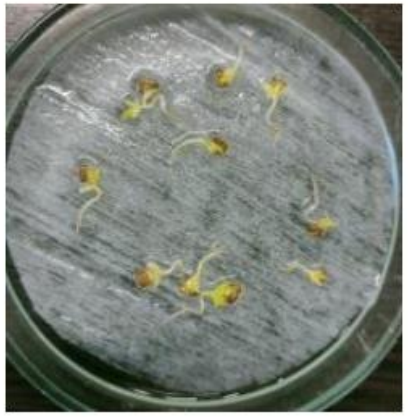
WW3



WW4

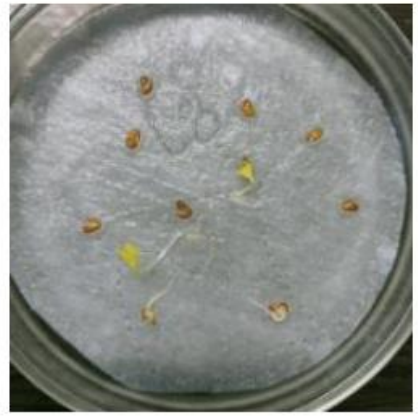
WW5

WW6



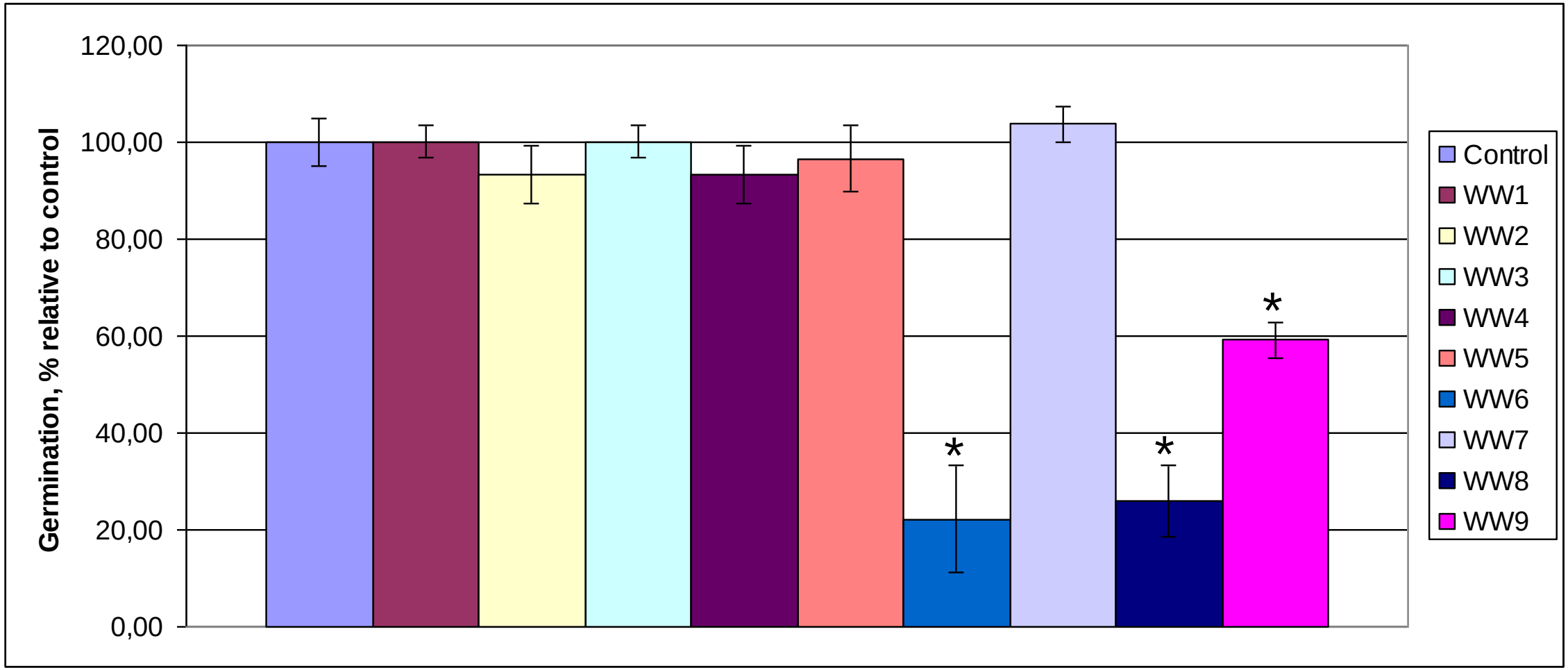
WW7

WW8



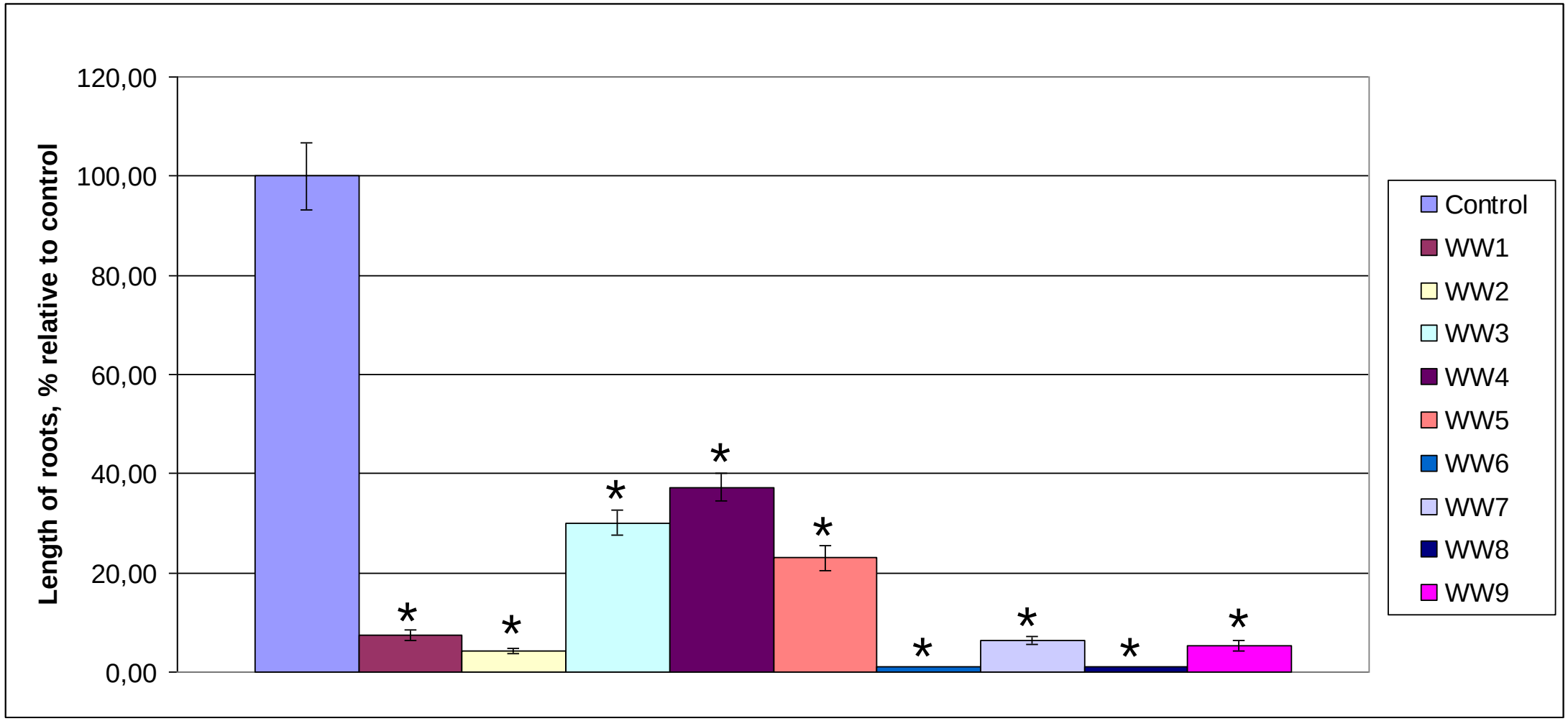
WW9

Germination, % relative to control



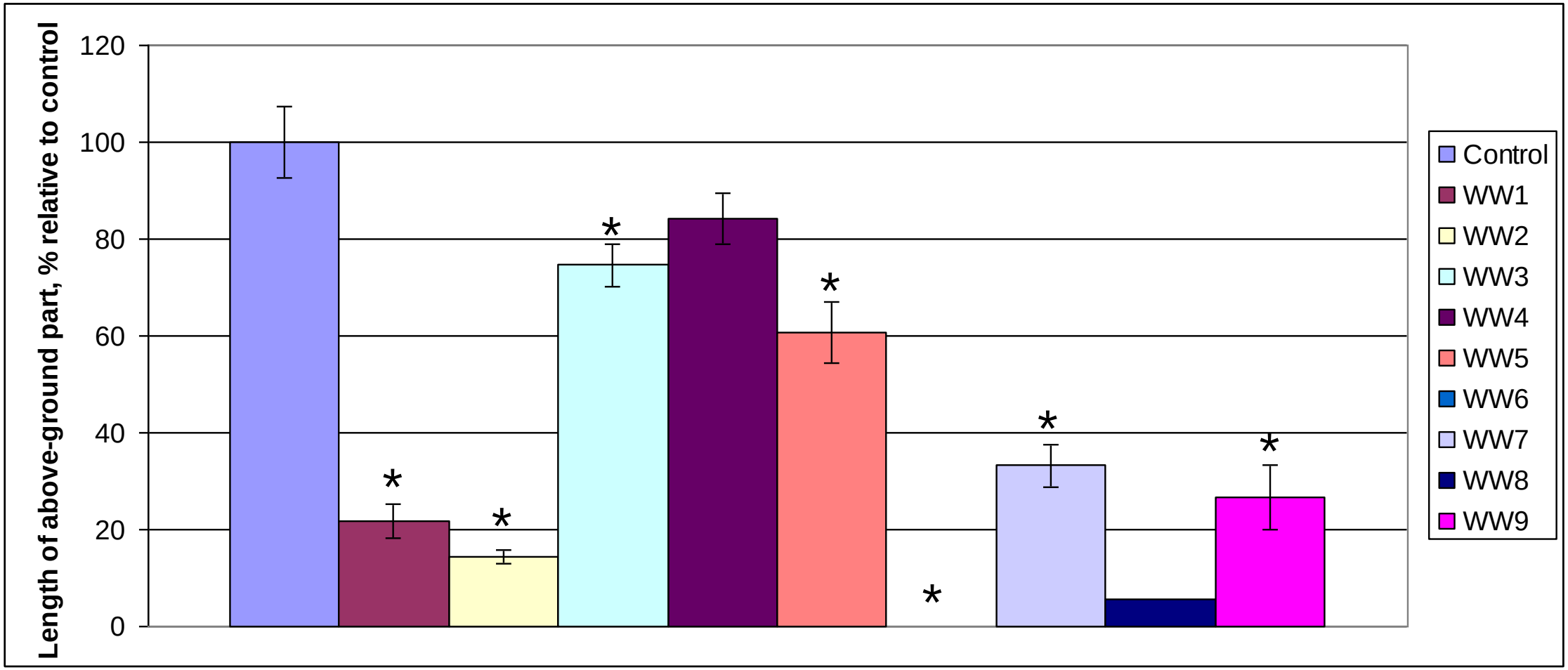
* - differences from the control are significant at p ≤ 0.05

Length of roots, % relative to control



* - differences from the control are significant at $p \leq 0.05$

Length of above-ground part, % relative to control



* - differences from the control are significant at $p \leq 0.05$

Interpretation of the bioassay data

Research option	SGI	RLI	Interpretation of the results of phytotest	Comments
Control	0.000	0.000	No toxicity	No inhibition of growth
Production of Ukraine				
WW1	0.001	-0.927	Extreme toxicity	Inhibition of growth more than 90%
WW2	-0.068	-0.958	Extreme toxicity	Inhibition of growth more than 90%
WW3	-0.001	-0.699	High toxicity	Inhibition of growth more than 60%
WW4	-0.068	-0.627	High toxicity	Inhibition of growth more than 60%
WW5	-0.034	-0.770	Extreme toxicity	Inhibition of growth more than 75%
Production of Turkey				
WW6	-0.778	-0.990	Extreme toxicity	Inhibition of growth more than 90%
WW7	0.037	-0.937	Extreme toxicity	Inhibition of growth more than 90%
WW8	-0.741	-0.990	Extreme toxicity	Inhibition of growth more than 90%
Production of the United Kingdom of Great Britain and Northern Ireland				
WW9	-0.408	-0.946	Extreme toxicity	Inhibition of growth more than 90%

Conclusions

1. 78% of the tested wet wipes (60% Ukrainian production and 100% foreign) showed extreme toxicity.

2. The tested wet wipes contain toxic substances (in particular, surface-active substances), show phytotoxicity and can be a source of environmental pollution.

Thank you for your attention!

Contact:

nataliia.smykun@gmail.com

zelenalyubov@gmail.com