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Croatian Case Study on Pesticide Residues in Olive Farming Systems within the SPRINT Project

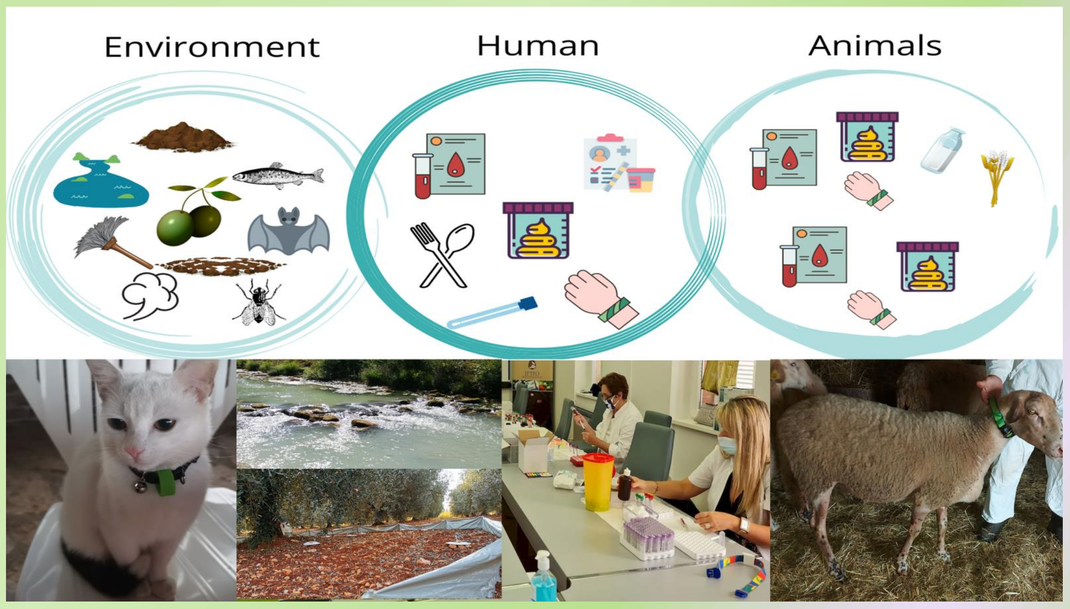
Igor Pasković, Marija Polić Pasković, Rima Osman, Zuzana Bílková, Irene Navarro, Adrián de la Torre, María Ángeles, Jonatan Dias, Hans Mol, Vivi Schlünssen, Abdallah Alaoui, Paul T.J. Scheepers, Vera Silva, Violette Geissen

Introduction:

In the EU, over 400 active ingredients for pesticides are currently approved for use (as listed on the EU pesticides database). Farmers often apply multiple products to their crops to protect them from pests and disease. The resulting residues can travel far and wide – for instance, in air and water, on food, or even on the soles of our shoes. This creates mixtures of pesticide residues – many of which are considered hazardous to humans, wildlife, and ecosystems. As part of the HORIZON 2020 SPRINT project, Croatia took part in a multinational assessment of pesticide exposure across diverse agricultural systems. The study covered organic (ECO) and conventional (IPM) farming practices.

Methods:

- 10 European case study sites (CSS) with 10 fields under conventional (IPM) and 10 under organic (ECO) farming
- The CSS covers the main crop – for Croatia– olive groves
- The Croatian case study focused on the Istrian region, where pesticide residues were analysed in environmental matrices - such as agricultural soil (olive groves), air, water, sediment, and household dust - as well as in biological samples from humans (blood, urine, feces, nasal swabs), livestock (sheep milk and feces), and companion animals (cats and bats).



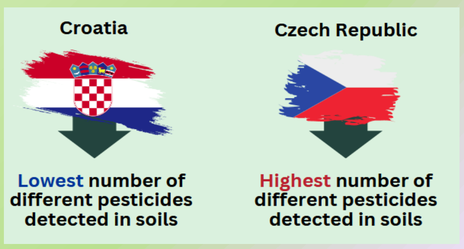
Most frequently detected pesticides in water (up to 20) with its median concentration

Pesticides	Frequency (%)	Concentration (ng/L)
Glyphosate	100	8.0
AMPA	100	3.0
p,p′ DDE	100	<0.1
Dieldrin	100	0.1
Hexachlorobenzene	100	0.1
Lindane	100	0.5
o,p′ DDE	67	<0.1
Piperonyl butoxide	67	0.5
Terbuthylazine desethyl	67	2.6
o,p′ DDT	33	<0.1
p,p′ DDT	33	<0.1
Permethrin	33	1.9
Pirimicarb desmethyl	33	2.8
Terbuthylazine	33	0.6
Trifloxystrobin CGA321113	33	0.8

Results:

Among the ten case studies targeting different crops, Croatian olive groves exhibited the lowest diversity of pesticide residues in soil. However, legacy pollutants such as DDT were still present, with DDT metabolite,

DDE, detected in 85% of soil samples, indicating the long-term persistence of banned substances. Surface water and sediment samples from Croatia similarly contained the fewest pesticide types and showed generally low concentrations.

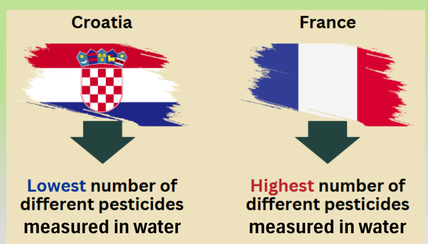


Most frequently detected pesticides in soil (up to 20) with its median concentration

Pesticides	Frequency (%)	Concentration (μg kg^{-1})
p,p′ DDE	85	1.3
AMPA	30	269.1
Glyphosate	25	62.7
Chlorpyrifos	20	5.0
Meptyldinocap phenol	15	2.1
Tebuconazole	15	74.9
Boscalid	10	133.9
p,p′ DDT	10	33.2
Acetamiprid	5	10.3
p,p′ DDD	5	3.4
o,p′ DDE	5	0.8
o,p′ DDT	5	3.5
Deltamethrin	5	35.5
Difenoconazole	5	4.6
Dimethoate	5	5.0
Dimethomorph	5	6.1
Hexachlorobenzene	5	0.4
Phosmet	5	5.9
Trifloxystrobin	5	10.2

Most frequently detected pesticides in sediment (up to 20) with its median concentration

Pesticides	Frequency (%)	Concentration (μg kg^{-1})
Tetramethrin	67	1.0
p,p′ DDE	33	0.5
Dicamba	33	83.1
Folpet PHI	33	5.9
Imidacloprid	33	1.4
S-Metolachlor	33	0.2



Environmental quality standards for surface waters are not exceeded. The WFD (Water Framework Directive) limit for individual pesticide concentration (0.1 μg/L = 500 ng/L) is not exceeded (in Croatia). The WFD (Water Framework Directive) limit for total pesticide concentration (0.5 μg/L = 500 ng/L) is not exceeded (in Croatia).

Most frequently detected pesticides in indoor dust (up to 20) with its median concentration

Pesticides	Frequency (%)	Concentration (μg kg^{-1})
Acetamiprid	100	5.1
Chlorpyrifos TCPy	100	3.1
Fipronil	100	2.6
Fludioxonil	100	2.8
Hexachlorobenzene	100	0.4
Imidacloprid	100	88.1
Lindane	100	1.3
Mandipropamid	100	3.2
Permethrin	100	4344.6
Piperonyl butoxide	100	997.0
2,4-D	94	20.6
Azoxystrobin	94	14.9
Carbendazim	94	29.5
p,p′ DDE	94	3.1
Dimethomorph	94	6.4
Diuron	94	4.0
Fipronil sulfone	94	3.0
Metalaxyl-M	94	4.1
Phosmet	94	236.4
Propamocarb hydrochloride	94	1.2

Household dust from olive-farming households also contained traces of multiple pesticides, though concentrations remained low regardless of production type. Notably, some of the detected compounds were classified as dual-use pesticides—used both in agriculture and in public health-related DDD measures (Disinfection, Disinsection, and Deratization).

Conclusion:

These results show that, although Croatia generally exhibits lower numbers and concentrations of the detected pesticides and residues, it is not exempt from their environmental presence. This further emphasizes the need to preserve the agricultural environment by transitioning to more ecologically friendly alternatives to synthetic pesticides and ensuring stricter control over their use.

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