



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Transgenerational toxic effects of [Omim]Cl and [DPy]Cl on the water flea, *Moina macrocopa*

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BACKGROUND

“Greener” Solvents

- Water
- Solvents derived from biomass
- Supercritical fluids
- Gas-expanded liquids
- Liquid polymers
- **Ionic liquids (ILs)**

ILs known as room-temperature molten salt



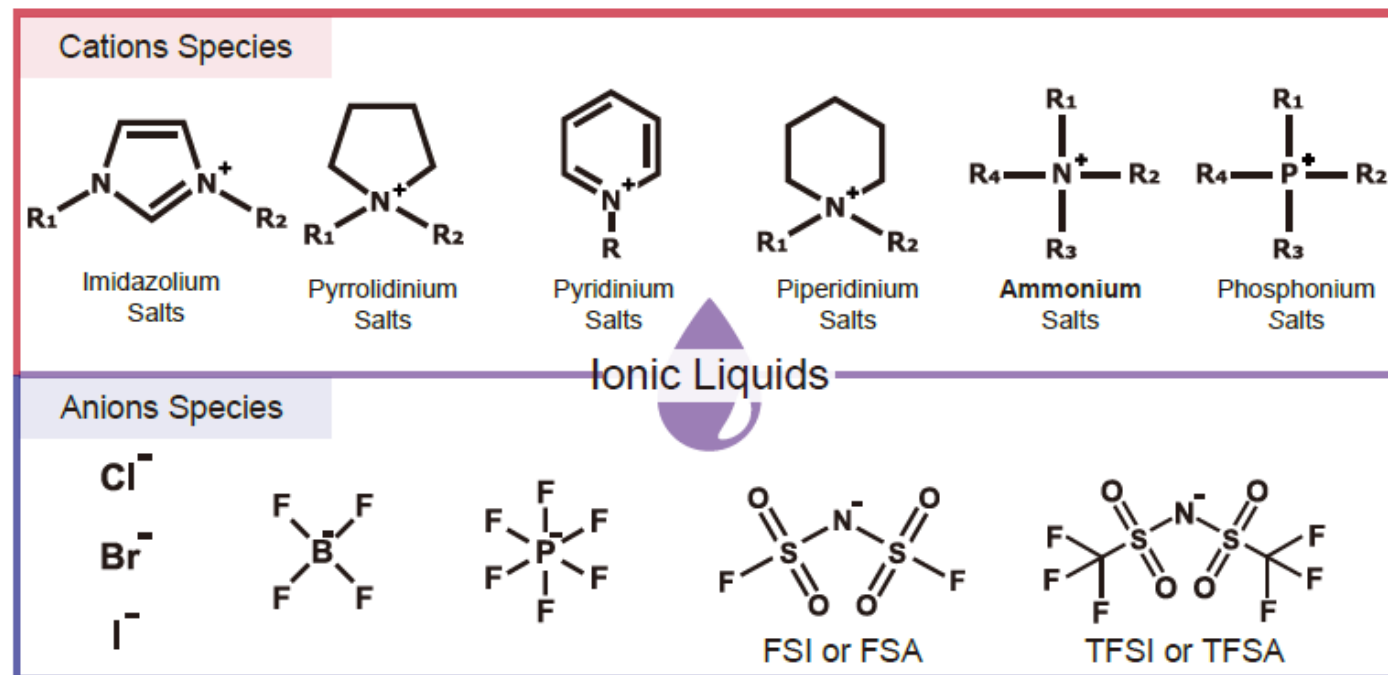
Joan Brennecke, 2009

BACKGROUND

Benefits

- Negligible vapor pressure
- High boiling points
- Low freezing points
- Low combustibility
- Excellent electrical conductivity
- High solubility in (in)organics
- Can be designed

Consists of a larger asymmetric organic cation & an anion



Typical cations and anions in ionic liquids (Kanto Chemical)

BACKGROUND

Hazards

- Harder to recycle than volatile solvent
- High water solubility, easily enter waters
- Weak photo-, biodegradability

Environmental Science & Technology

Viewpoint
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Ionic Liquids: New Emerging Pollutants, Similarities with Perfluorinated Alkyl Substances (PFASs)

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Due to their water solubility and low biodegradability, ionic liquids are potential persistent aquatic pollutants. Furthermore,

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Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Journal of Hazardous Materials xxx (xxxx) xxx

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Reproductive toxicities of 1-ethyl-3-methylimidazolium bromide on *Caenorhabditis elegans* with oscillation between inhibition and stimulation over generations

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Ecotoxicology and Environmental Safety 190 (2020) 110137

Contents lists available at ScienceDirect

Ecotoxicology and Environmental Safety

journal homepage: www.elsevier.com/locate/ecoenv

New insights on the effects of ionic liquid structural changes at expression level: Molecular mechanisms of toxicity in *Daphnia magna*

Guilherme Jeremias^a, Fátima Jesus^a, Sónia P.M. Ventura^b, Fernando J.M. Gonçs Jana Asselman^c, Joana L. Pereira^{a,*}

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Ecotoxicology and Environmental Safety 190 (2020) 110137

Contents lists available at ScienceDirect

Ecotoxicology and Environmental Safety

journal homepage: www.elsevier.com/locate/ecoenv

The effects of 1-hexyl-3-methylimidazolium bromide on embryonic development and reproduction in *Daphnia magna*

Miao Yu^a, Chuanhu Liu^b, Honghao Zhao^c, Yanjing Yang^c, Jinhui Sun^{a,*}

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^c College of Fisheries, Tianjin Agricultural University, Tianjin, 300384, China

The ecological impact has been considered a big issue

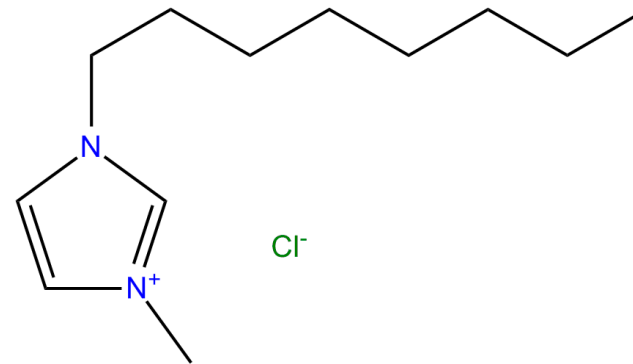
BACKGROUND

To date, knowledge on how ILs affect crustaceans is limited,
especially effects over generations

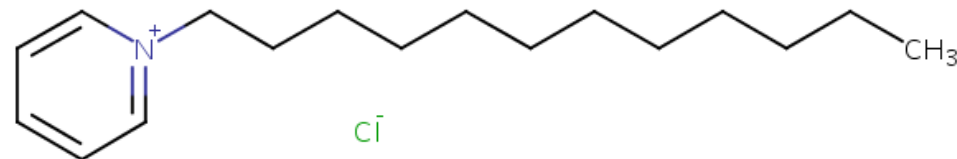
OBJECTIVE

To compared transgenerational effects of on *Moina macrocopa*:

[Omim]Cl: 1-methyl-3-octylimidazolium chloride



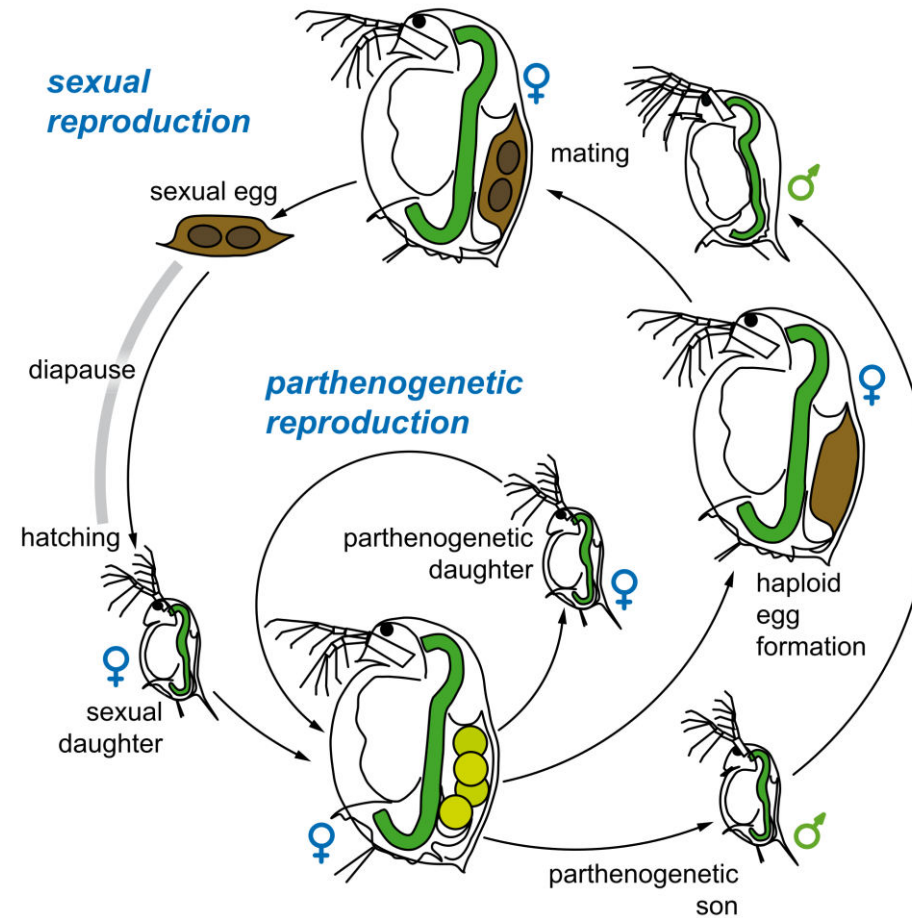
[DPy]Cl: 1-dodecylpyridinium chloride



METHODS

Moina macrocopa

- Widespread around the world
- Widely used in toxicity test



METHODS

Moina macrocopa



Acute toxicity

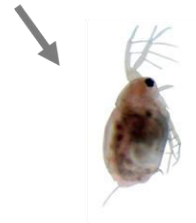
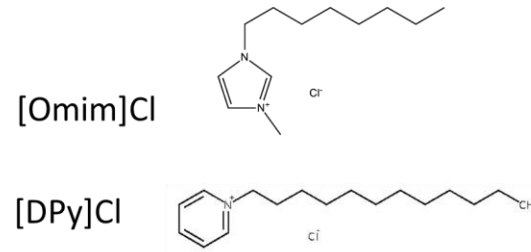
— LC₅₀



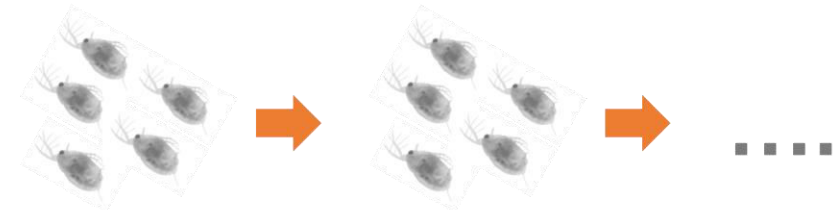
Chronic toxicity



Transgenerational toxicity



Transgenerational effects



Unexposed generations

- Survivorship
- Development
- Reproduction

RESULTS

Acute Toxicity

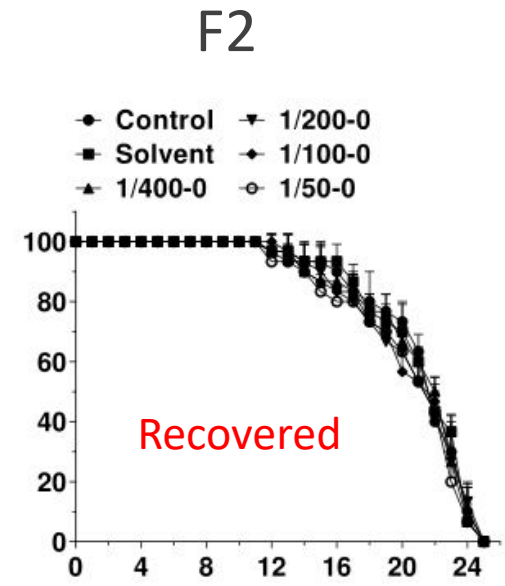
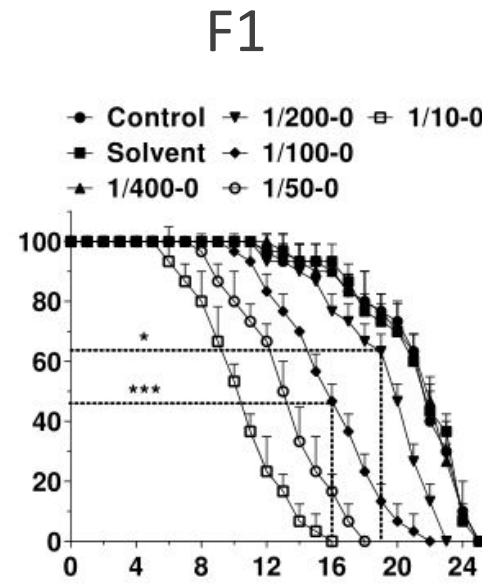
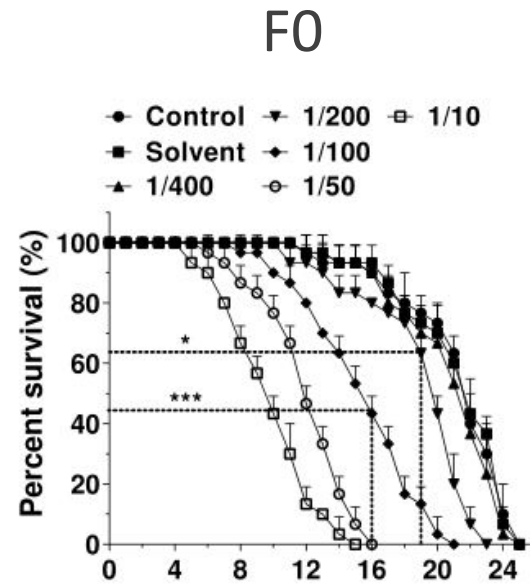
Exhibited **high toxicity** to *M. macrocopa*

(hazard ranking defined by Passino, 1987)

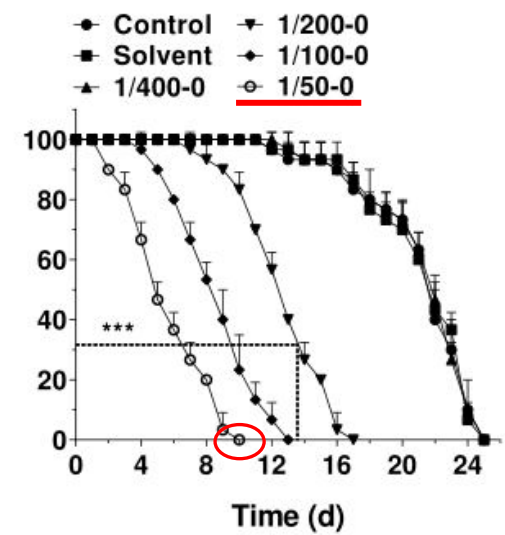
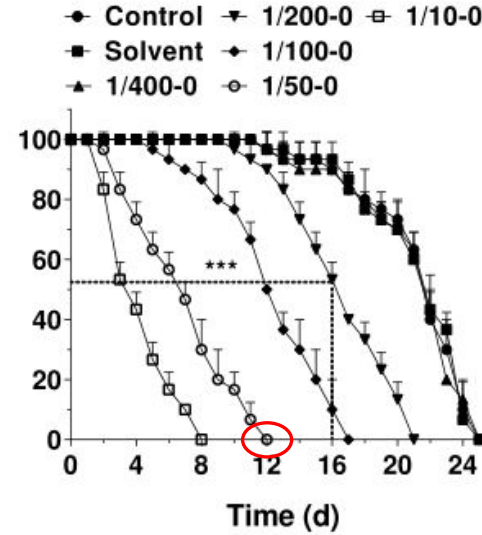
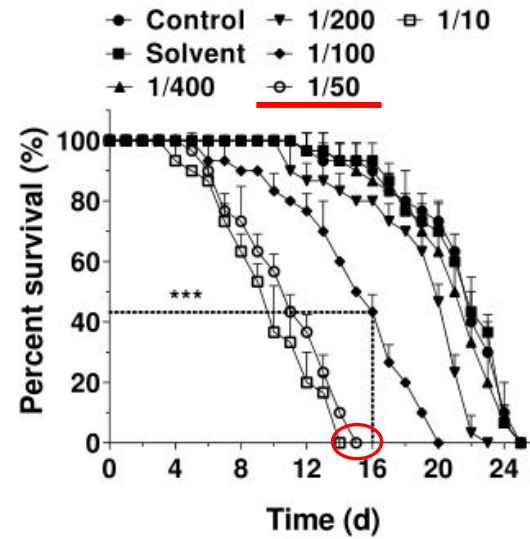
Chemical	Time (h)	LC ₅₀ (mg/L)	95% confidence interval	Regression equation	Correlation coefficient (R ²)
[Omim]Cl	24	0.83	0.57-1.09	y=4.5297x+5.371	0.9537
	<u>48</u>	<u>0.67</u> < 1	0.46-0.88	y=4.411x+5.7774	0.9797
	72	0.45	0.29-0.61	y=5.2673x+6.8348	0.9785
[DPy]Cl	24	0.49	0.37-0.61	y=3.0597x+5.9512	0.9344
	<u>48</u>	<u>0.47</u> < 1	0.37-0.57	y=1.5461x+5.5022	0.9566
	72	0.36	0.21-0.51	y=4.5975x+7.0288	0.9833

RESULTS

Effects on Survivorship



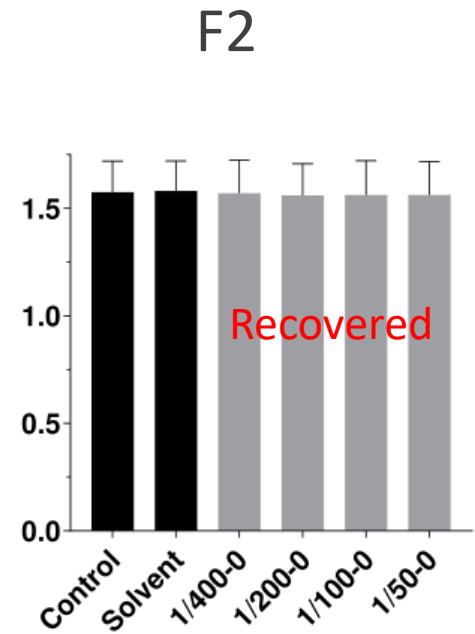
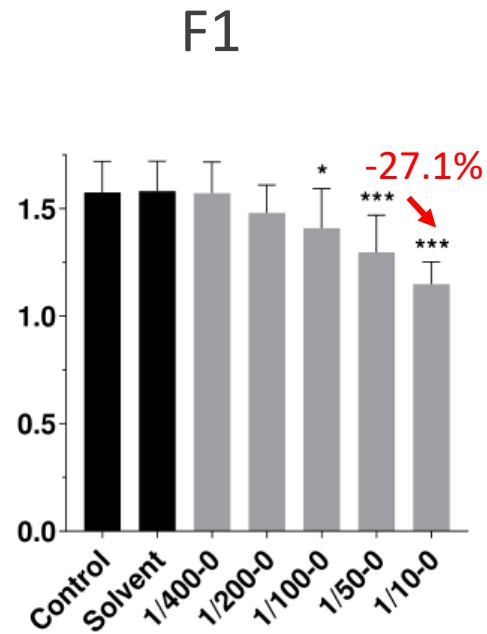
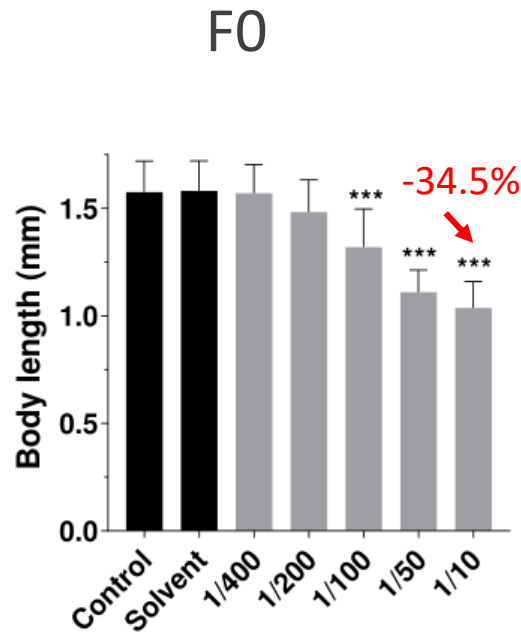
[O_{mim}]Cl



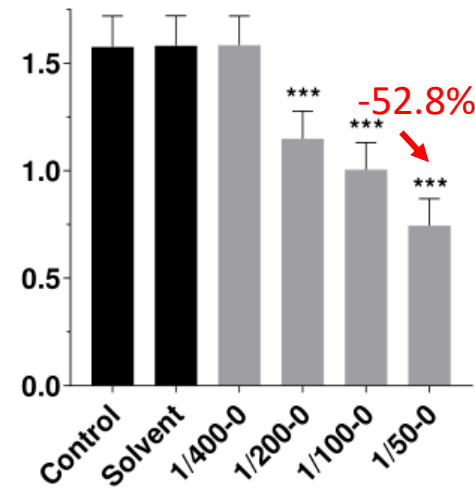
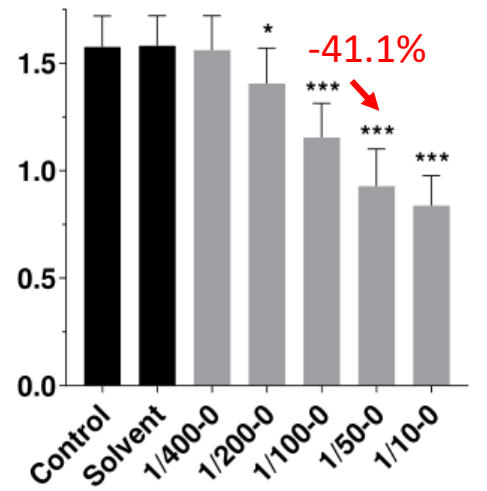
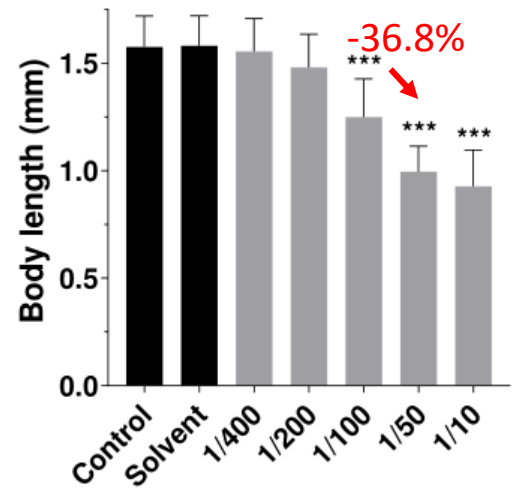
[DPy]Cl

RESULTS

Effects on Development



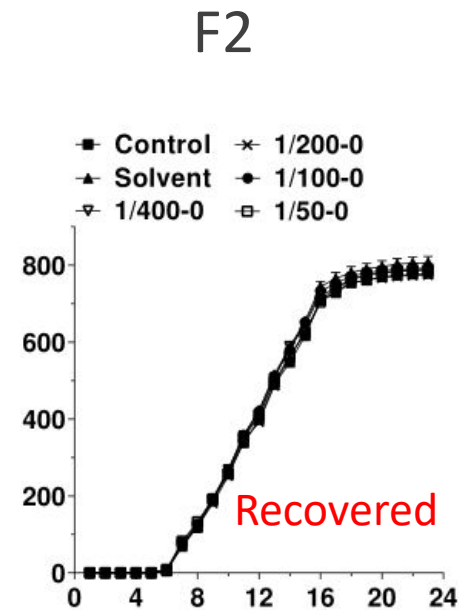
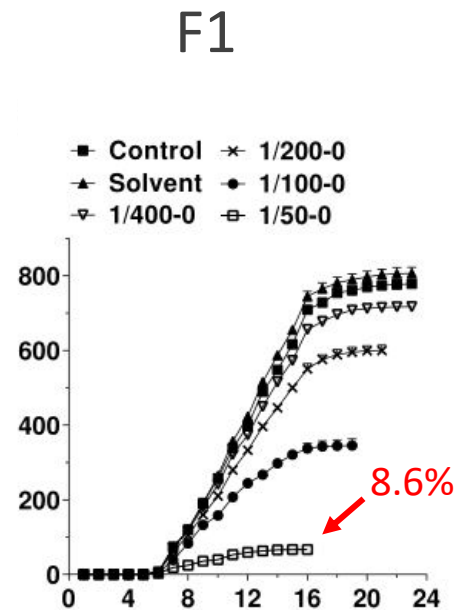
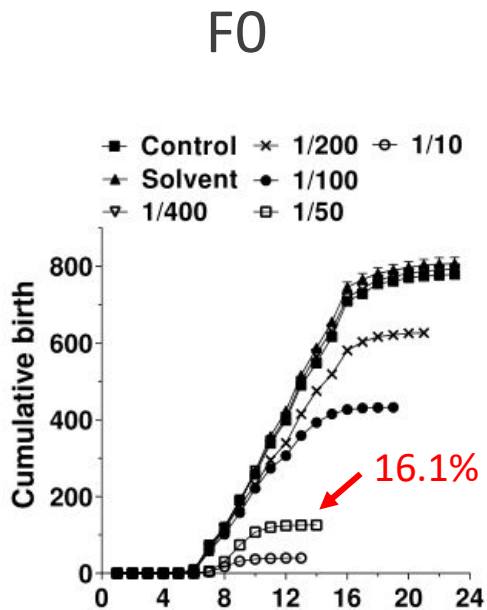
[Oimim]Cl



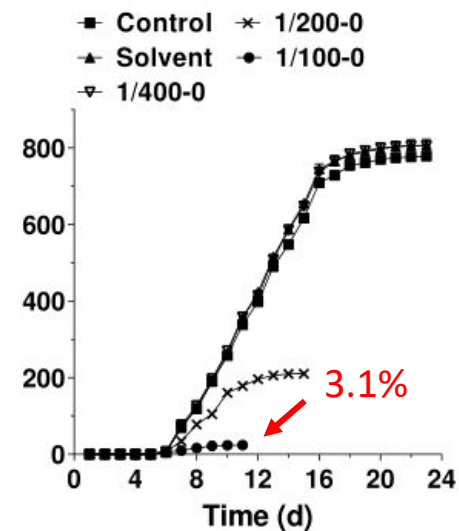
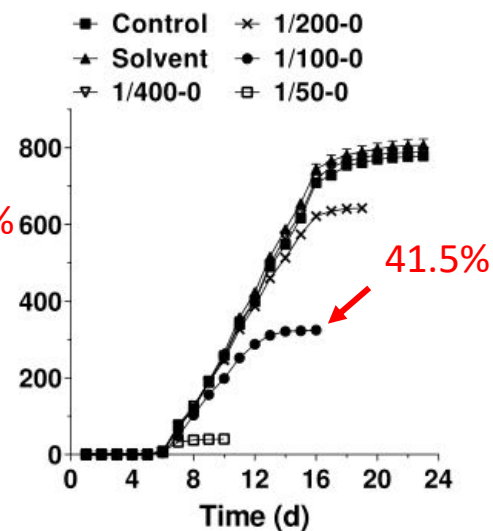
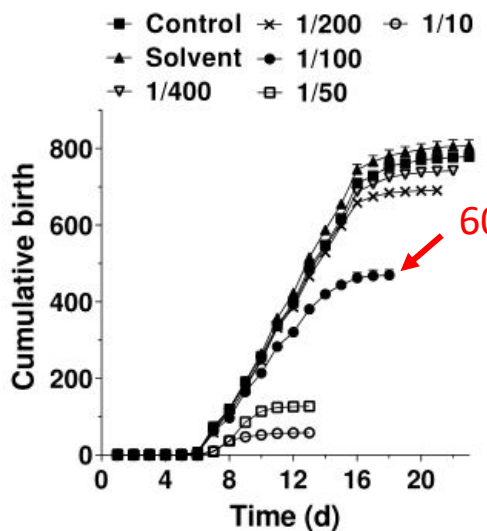
[DPy]Cl

RESULTS

Effects on Reproduction



[Ovim]Cl



[DPy]Cl

CONCLUSIONS

- [Omim]Cl and [DPy]Cl exhibited high toxicity to *M. macrocopa*
- Chronic exposure shortened its life expectancy, repress its body development, reduce its fecundity
- Effects of [Omim]Cl recovered in 3 generations, but effects induced by [DPy]Cl continued

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THANK YOU !

