Chemical pollution affects the behaviour of mosquito larvae

MARTIN DESSART, MIGUEL PIÑEIRUA, CLAUDIO LAZZARI, FERNANDO GUERRIERI

IRBI Institut de Recherche sur la Biologie de l'Insecte

dessart@univ-tours.fr

INSTITUT DE RECHERCHE SUR LA BIOLOGIE DE L'INSECTE | UMR 7261 CNRS | UNIVERSITE DE TOURS, FRANCE

INTRODUCTION

TWO SOURCES OF ANTHROPOGENIC POLLUTION

Domestic & industrial wastes

- Medicine drugs
- Detergent
- Heavy metals

Agricultural run-off and wastes

- Pesticides residuals
- Herbicides residuals
- Fertilisers

Acute pollution
Rain water | Atmosphere

Chronic pollution
Groundwater

MOSQUITO LARVAE AS A BIOLOGICAL INDICATOR

Perform stereotypical escape behaviour

Ecologically relevant

Water/air interface

Rearing facilities at low cost

Public health concern

METHODS

1) MOSQUITO REARING

Aedes aegypti eggs → 5-8 days of development → 4th instar

CHRONIC POLLUTION

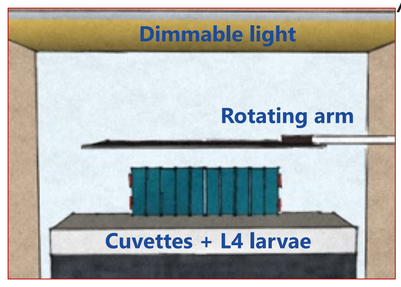
Control | Glyphosate | Atrazine | Paracetamol

ACUTE POLLUTION

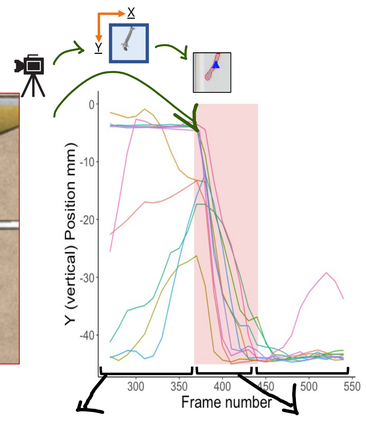
→ Sprayed (on crops)

→ Residual (found in soil)

2) AUTOMATIC DEVICE



3) DATA EXTRACTION

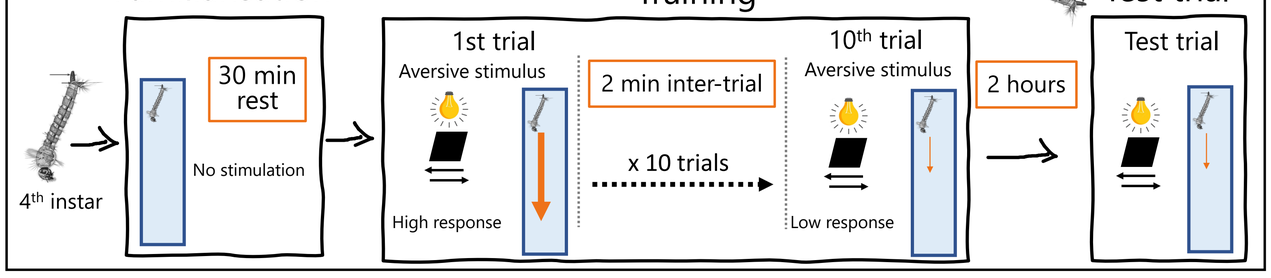


ACTIVITY

LEARNING

MEMORY RETENTION

EXPERIMENTAL DESIGN

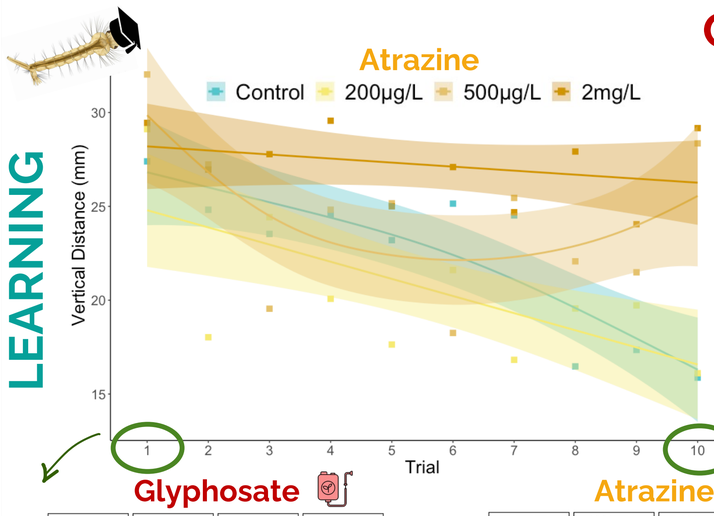


HOW ACUTE AND CHRONIC POLLUTION AFFECT MOSQUITO LARVAE LEARNING & MEMORY ABILITIES ?

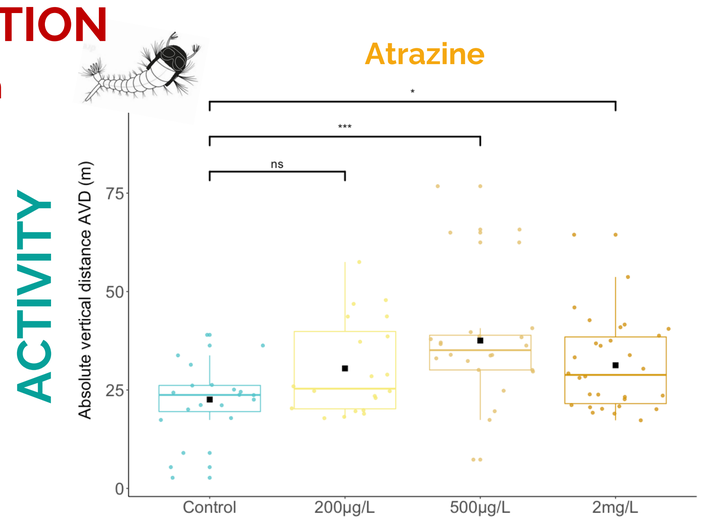
CHRONIC POLLUTION

Larvae are reared in polluted water

LEARNING



ACTIVITY



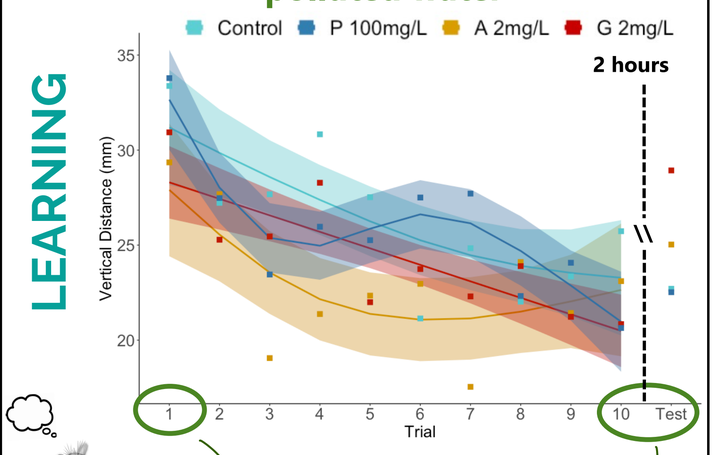
SUMMARY

	Learning assessment	Distance travelled (m)	Average speed (mm/min)	Maximum speed (mm/min)	Time spent moving (%)	Number of diving event (%)
100 µg/L	No learning	x	x	↘	x	x
200 µg/L	No learning	x	x	x	x	x
2 mg/L	No learning	x	x	↗	x	x
200 µg/L	OK	x	↗	x	x	↗
500 µg/L	No learning	↗	↗	↗	↗	↗
2 mg/L	No learning	↗	↗	↗	↗	↗
1 mg/L	OK	x	x	x	x	x
10 mg/L	OK	x	x	x	x	x
100 mg/L	OK	x	x	x	x	x
0.126 µg/L 2.3 µg/L 6 µg/L	No learning	x	x	x	x	↗
1mg/L 200 µg/L	OK	x	x	x	x	x

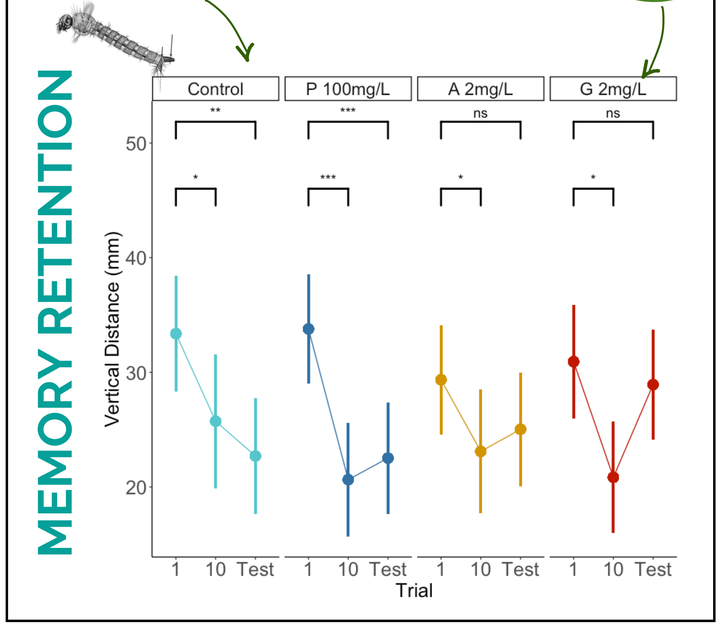
ACUTE POLLUTION

Larvae are trained in polluted water

LEARNING



MEMORY RETENTION



DISCUSSION

Glyphosate impaired **learning** at **residual dose** (<100 µg/L) and **memory** retention at **spray dose** (2 mg/L)

Atrazine impaired **learning** at **residual dose** (<200 µg/L), slightly **altered memory retention** at **spray dose** (2 mg/L) and highly **increased** individual **activity**

Paracetamol alone had **no effect** on larvae **learning** and **memory** abilities

In **cocktail**, low doses of the **three chemicals** (Gly. 0.126 µg/L, Atr. 2.3 µg/L, Par. 6µg/L) **impaired** mosquito **learning abilities**

The understanding of the **neurotoxic impact** of common **chemicals** is still very **limited**

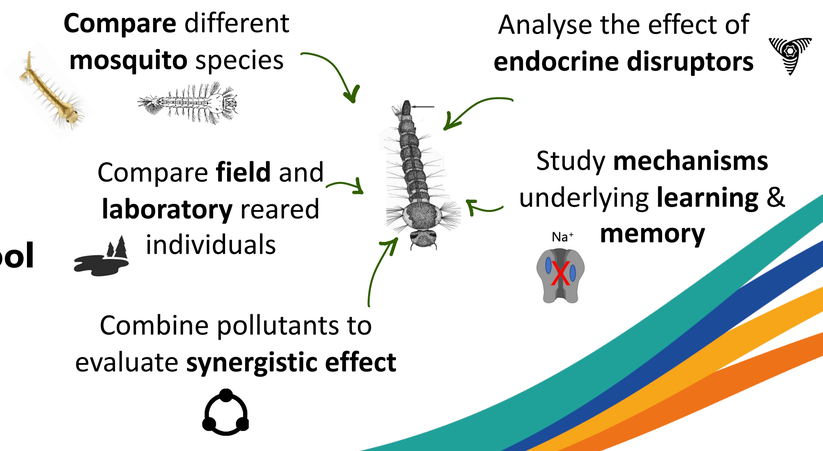
High-throughput variables and **automatic bioassays** represent a sensitive and **objective tool** to **quantify** insect behaviour

The results suggest that we could **use mosquito larvae** as **a biological indicator** to evaluate the quality of **aquatic environments** submitted to **anthropic influence**

→ **Consistent** with literature on other organisms

→ First study showing that **atrazine** affects **learning** and **memory** in an insect

→ First study assessing **synergistic effect** on learning in an insect



52ème colloque de la SFECA
Tours - Mai 2023