Variability of Cd-sensitivity and phylogenetic diversity of field populations throughout the Gammarus fossarum/pulex species complex

A. Vigneron, Olivier Geffard, H. Pellerin, R. Recoura Massaquant, A. Francois, H. Quéau, Thierry Rigaud, R. Wattier, Arnaud Chaumot

▶ **To cite this version:**

A. Vigneron, Olivier Geffard, H. Pellerin, R. Recoura Massaquant, A. Francois, et al.. Variability of Cd-sensitivity and phylogenetic diversity of field populations throughout the Gammarus fossarum/pulex species complex. SETAC Europe 24th Annual Meeting, May 2014, Basel, Switzerland. pp.1, 2014. ⟨hal-02600162⟩

HAL Id: hal-02600162

https://hal.inrae.fr/hal-02600162v1

Submitted on 16 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

HAL Authorization

Variability of Cd-sensitivity and phylogenetic diversity of field populations throughout the *Gammarus fossarum/pulex* species complex.

Amandine Vigneron[1], Olivier Geffard[1], Hugues Pellerin[1], Rémi Recoura-Massaquant[1], Adeline François[1], Hervé Quéau[1], Thierry Rigaud[2], Rémi Wattier[2], and Arnaud Chaumot[1]

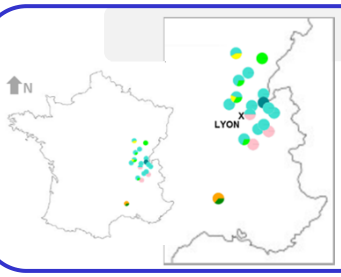
[1]Irstea, UR MALY, 5 rue de la Doua – CS70077, F-69626 Villeurbanne, France

[2]UMR CNRS/uB 6282 Biogéosciences, Université de Bourgogne, 6 bd Gabriel, 21000 Dijon, France

Context: Gammarids from the pulex group are commonly used in ecotoxicological tests. This taxonomic group is known to be a highly diversified **complex of morphological and cryptic species**, and affiliation to a lineage is claimed to be a driving factor for toxicant sensitivity. Phylogenetic determinism hence **challenges the reliability of ecological risk assessment** of chemicals since it could contribute to the reported between-population/species variability in response to contamination in gammarids, and jeopardizes the representativeness of toxicity tests performed with one experimental population.

Objectives: Here we aim to evaluate whether there are **sensitivity deviations** to cadmium within the *G. fossarum/pulex* species complex and to assess the potential confounding effect of the **phylogenetic signal** in the sensitivity to this model contaminant in this species group.

1. Studied populations



- Broad sample of 18 field populations
- Populations inhabiting pristine stations
- Populations spread out at a regional scale (in the Rhône-Alpes region, Southeast of France) in various ecological (creeks, mountain brook, streams, floodplains) and geological contexts (limestone, crystalline areas)

Design in order to cover:

➡ A large range of physico-chemical characteristics to **take into account confounding factors**

➡ The **phylogenetic diversity** of the *G. fossarum/pulex* complex

2. Lineages identification

- Genotyping from the nucleotide sequence of a 710-pb segment of the mitochondrial cytochrome *c* oxydase subunit I gene (COI)
- At least 12 individuals per population

Fig. 1: COI phylogenetic tree of the *Gammarus fossarum/pulex* complex computed from all individuals analysed; and phylogenetic composition of populations, pie slice proportional to the number of individuals of each lineage.

➡ 256 individuals; 82 new haplotypes

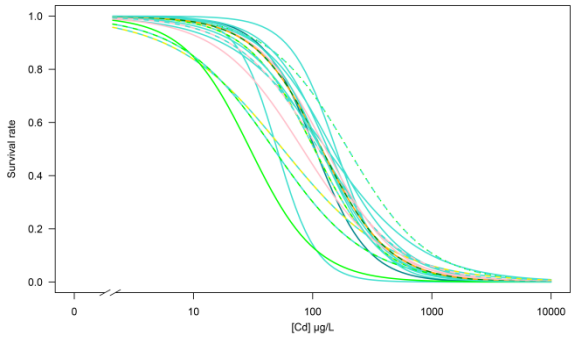
➡ 6 divergent fossarum groups, and 3 pulex groups

➡ 9 fossarum B populations, 2 fossarum W populations, 1 pulex population, 6 sympatric cases

3. Cd-sensitivity assessment

- 7 days semi-static exposure to 6 levels of cadmium (Cd) (0, 20, 40, 80,160 and 320 µg/L, water hardness 140 ± 10 mg$CaCO_3$/L)
- 3 replicates of 15 males with homogeneous size for each level
- Analysis performed with the drc package in the R software

Fig. 2: Dose-response curve of each population - 4 days of exposure



➡ Differences in sensitivity between populations

➡ $LC50_{96h}$ of pure-stand populations

* Mean $LC50_{96h}$ of 7 populations for B, and 2 for W

** $LC50_{96h}$ TANC

	$LC50_{96h}$ (SD)
G. fossarum B	123,2 (22,4) *
G. fossarum W	124 (6,8) *
G. pulex	29,9 **

Conclusions

➡ Within *G. fossarum*, Cd-sensitivity of lineages B and W are in the same range. Thus, in the particular case of acute Cd toxicity, we **do not conclude to a phylogenetic signal within *G. fossarum*.**

➡ We suggest that ***G. pulex* could be more sensitive** than *G. fossarum* but a larger sample of pure-stand populations is necessary in order to conclude about a phylogenetic signal in Cd-sensitivity between these two groups.

➡ In addition levels of Cd-sensitivity reported in the literature are in the range of the variability revealed here (Fig 3). It reinforces the importance to study a **broad sample of populations** to ensure that reliable conclusions could be drawn.

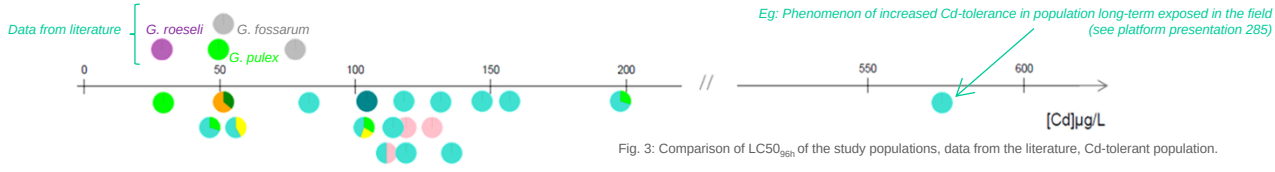


Fig. 3: Comparison of $LC50_{96h}$ of the study populations, data from the literature, Cd-tolerant population.

➡ The variability observed between populations suggests that **environmental factors** may have a leading role in Cd-sensitivity. Local ecological adaptations should be investigated to understand between-population heterogeneity in sensitivity to contaminants in gammarids.

The authors thank ANR CESA program Gamma, ANR Blanc Multistress, program ONEMA Phylopol

Feckler et al (2014) *Journal of Applied Ecology* (Online Version). Folmer et al (1994) *Molecular Marine Biology and Biotechnology* **3**(5):294-299. Weiss (2014) *Hydrobiologia* **721**(1):165-184. Boets et al (2012) *Ecotoxicology* **21**(4):1135-1144.